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Electrical World

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The Washington Investigation and the Information Bureaus

AS THE time draws near when the Federal Trade Commission will conclude its investigation of the various state public utility information bureaus, one cannot but be impressed with the sorry spectacle made in their testimony by these masters of publicity. This has been due primarily to the *ex parte* nature of the hearings and to the manner in which the examinations have been conducted, but the ego and love of exaggeration of the press agent also form part of the story. Unfortunately, the public utility industry is judged by the statements of the most incompetent of these men and the public reaction is anything but good. Distorted though the newspaper accounts may be, they are what reach the public, which in the presentation made can only conclude that it has been imposed on and made the dupe of insincere statements put forth for that end.

Of course, if the complete story of the industry could be told by the men who have been part and parcel of it, a different impression might be created; but we doubt very much whether a chance will be given to the industry to vindicate itself before the Federal Trade Commission. It has already been damned and cast into outer darkness by the scandalmongers, and the public relations work of years has been undone. Does this mean that the utility companies should cease all publicity work? Quite the contrary. The public utilities of the country should double and quadruple their efforts to command public understanding and respect, but information bureaus must hereafter be under stricter executive guidance and direction. That has been made all too plain by developments in Washington.

* * * *

Bond Issues Are Withheld from Falling Market

THE remarkable paucity of public utility bond issues now being offered is due, not to a lack of demand for new capital, but to a well-considered policy on the part of the investment banking fraternity. There is much senior financing to be done, but the present weakness in the bond market apparently demands the policy of postponement which has been adopted.

This time last year the volume of bond debenture financing was unusually large. New financing of this type on the part of power and light companies during April and May alone exceeded $200,000,000. Early in the summer the bond market began to display a downward tendency, but the volume of new issues was not reduced until a rather serious congestion occurred throughout the investment market as a whole. It was some time before shelves were cleared. The bankers and those sponsoring new issues are carefully guarding against a repetition of this situation. There is much refunding still to be done, and this will effect marked economies. It is apparently the consensus of opinion in banking circles, however, that refunding economies may easily be wiped out if too many issues are thrown on the market indiscriminately at a time such as the present.

* * * *

Mergers Predicated on Banking and on Service

BANKERS peering into the future profess to see in the offing business changes as momentous and as far-reaching as any of those already experienced in recent years. Throughout the convention of the American Institute of Banking in Philadelphia last week that note was dominant. Naturally, there was also a feeling of apprehension, for bankers are as a rule conservative; but conservatism did not becloud the picture of the tremendous industrial evolution which every one, including the bankers, knows is taking place in this country. Continued mergers of banking institutions are looked for; but here the bankers, although in step with the general trend of industry, are face to face with the problem confronting executives of utility companies—a dearth of skilled men.

Holding companies in the public utility field are admonished to adopt a plan of "merciless publicity" and a complete willingness to co-operate with public authorities as a safeguard against trouble and public disfavor. For adequate funds with which to carry on their operations holding companies will probably resort to debentures more than ever, and if these are readily absorbed, the electric light and power industry ought to continue unhampered its onward march. Of course, if money were all that were needed to conduct the public utility business—and money is most important—and if mergers could always be relied on to work out as planned or expected, the outlook would be roseate.

But there are other problems just as perplexing as finance. In union there is strength, but very little if it is a union of brass and lead. New holding companies and new investment companies are springing into being very rapidly of late, and unless wisdom and knowledge are displayed in combining or buying into properties, the combinations are bound to come to grips. Mere combination offers no royal road to fame and riches. Weak properties may be kept alive by transfusion with some strong property, but if the property is hopelessly anemic, it is a burden to the strong property and combination will not save it. Bankers are too prone to believe that mere manipulation of shares suffices to effect solidarity.

It will, if the combination is a logical one; but only a seasoned operator of public utilities can tell that. The market of the electric public utility industry is exceedingly bright, but its development must be intrusted to skilled utility men who will not easily be led astray during periods of cheap money. The object of all combinations should be better, or more economic and reliable, service, in keeping with the wants and needs of the community. Operators must never lose sight of that.

* * * *

Becoming "System-Minded"

IT IS essential that the rising generation of electrical engineers regard their daily problems with a broader outlook than in the past. They must become "system-minded"—as they have become "automobile-minded" and are fast becoming "air-minded."

The past generation had to do with small systems, usually comprising one generating plant and a few radial feeders. They were isolated by distance and were developed along individual ideas—often widely divergent. The head of each department was a law unto himself. He had mastered his own duties but usually knew very little else outside his immediate sphere.

The present large systems and the intricate combinations resulting from interconnections of larger systems have introduced many problems which cannot be successfully solved by the old methods. Planning for many years into the future is an absolute necessity if economy and successful operation are to accompany expansion. Each new development in any part of the system, no matter how small, should be made with an eye to its relation with and its influence upon the system as a whole. It should be an efficient link in the chain, not only fulfilling its own immediate purpose but assisting adjacent members to reach the highest state of efficiency.

The men who are in charge of the work, whether planning, installing or operating, must get themselves in the habit of seeing beyond the local problem. They must think and work in terms of the system. They must become "system-minded."

* * * *

Evidence of Progress by Industry Sales Conference

THERE is good news in the announcement that the Industry Sales Conference has retained a prominent advertising agency to assist in the development of the sales program for which electrical men are waiting. That they are waiting expectantly cannot be questioned. It was clearly evidenced at the recent conventions of the manufacturers, the jobbers and the power companies. The contractor-dealers are pinning great hopes upon the conference. For the four branches of the industry have appointed the men considered best for the job and asked them to find together the way to bring about the adequate wiring and equipment of the millions of homes now connected where further sale of electric service is largely blocked by inadequate facilities for the use of appliances. A fund has been provided, principally by the power companies and the manufacturers, to finance the preparatory work.

The conference has wisely sought expert advice. After all, this is not primarily an electrical problem. It is a problem of how to sell in the popular market. Why do the American people spend so small an amount for electrical equipment compared with other modern luxuries and conveniences? That is the question. It will be worth a good deal to have some unprejudiced outsider study this and find the answer, for any large market development by the electrical industry in the homes will have to be achieved through increasing the popularity of electrical appliances in direct competition with the other good things of life. We will have to change the present public attitude toward these relative appeals.

It may be expected that by fall whatever research is necessary will have been completed and that a plan and program will be ready for the consideration of the industry. The conference believes that this program must embrace three things—the sale of adequate wiring on a large scale, the education of the small contractor to better business standards, and a greater pressure of popular advertising by the electrical industry. It is a large order. It will require generous appropriations by the national associations and by companies. But nothing less will be effective.

* * * *

Too Many Variables Exist in Transmission Problems

CONTINUITY of service by high-voltage transmission lines is a problem of unceasing interest and importance. The economic rewards of first-class service are matched by its effect on public relations. Notable progress is being made in the study of the phenomena underlying transmission practice, and the pioneer work of the manufacturers' laboratories is being supplemented by increased efforts to co-ordinate field observations and deduce from these the relative value of various protective methods. The number of variable factors affecting conclusions, however, is still too great to satisfy critical engineering judgment.

An interesting discussion of flashover problems has recently been published by the overhead systems committee of the Engineering Section, New England Division, N.E.L.A., based on a series of tests made last year on the 66-kv. circuits of the Turners Falls Power & Electric Company. Analysis of motion-pictures taken at the time led some engineers to accept three conclusions: (1) Devices on the line ends of insulator strings give about 10 per cent additional protection; (2) devices on both ends of insulator strings give about 54 per cent increased protection; (3) electric control devices are required when short circuits materially exceed 240 amperes, because of damage to insulators. Other engineers differed widely in their interpretations of the test data.

Actually, such tests on lines in the field are highly useful, even if generally acceptable conclusions are as yet unattained. We see these variables face to face when we seek to interpret such data. It is very important to accumulate a large number of observations upon the behavior of insulators and power arcs following up flashovers under a wide range of conditions on operating systems. We need more light upon many things—on the effect of arcing horns, grading rings, inter-disk gaps and distribution of voltage stresses; on the number of test "shots" and field flashovers reasonably necessary to permit detailed conclusions on a single line, on a system and between systems; on the relative effect of circuit breakers and power arc breaks on surge formation; on the amount of energy justifying particular inter-

pretations; on the influence of wind conditions, the value of shorter disk spacing, the types of connections between units of strings, and so on.

The art of transmission has reached a stage where it justifies liberal outlays of time and money for assembly and analysis of facts bearing upon local flashovers and interruptions. Free interchange of data among those competent to discuss such problems is also essential.

* * * *

Benefits Available if Efforts Are Expended

POSSIBILITIES for increased sales and improvement of a system load factor through the sale of electrical energy for industrial heating are enormous. But this class of load will not knock on the door for admittance. Competition is keen. The manufacturers of natural gas and fuel oil are competitors. The industrial man must be convinced of the advantages of electricity for industrial heating. The selling can be done by the manufacturers of heating equipment and by the utilities. Each must do its share, as the most effective work can be accomplished only through co-operation.

The industrial heating committee of the N.E.L.A. has prepared considerable data on methods of surveying the utility's territory for the adaptation of electric heat to specific applications and on the results that have been accomplished. A five-reel motion picture entitled "Electric Heat in Industry" has been prepared for the use of utilities. When shown before prospective customers it is a most convincing salesman. From time to time the committee sponsors schools for the training of industrial electric heating engineers.

It remains for the utilities to take advantage of these opportunities to increase their business. No group should be more interested than they.

* * * *

Transmitting Power Through Insulation

AN INTERESTING case of apparent paradox in present-day electrical engineering is the series capacitor, which has recently been applied for the first time to transmission-line practice. A group of three of these capacitors has been placed in series with a 20-mile, 33-kv. line running between Amsterdam and Ballston Spa., N. Y., and the entire 7,500 kva. which passes over the line is transmitted through their dielectric.

This may seem a startling thing, since the profession has been engaged for years in the development of better solid and liquid dielectrics to withstand the increasing voltages used in transmission and the better to protect transformers and other apparatus from high potential disturbances resulting from lightning and switching operations. To be sure, any one who is familiar with radio knows that the high-frequency impulses travel through the dielectric of the condensers. But when it comes to commercial power, measured in thousands of kilowatts, it seems a pure figment of the imagination.

Operating data taken over a period of four months on the New York Power & Light Corporation's system give strong evidence that there is no paradox involved in transmitting power through insulation. The three series capacitors have been in continuous service during that period, transmitting regularly, day after day, as much as 5,000 kva. from the bus of the Amsterdam steam station into the system at Ballston and beyond to Spier Falls.

The importance of the capacitor lies in its ability to neutralize line reactance at all loads. The 20-mile line in which the group of capacitors is connected operates without reactance drop, achieving the voltage characteristics of direct-current transmission. And long-distance direct-current transmission has been the dream of engineers since the time of Edison's Pearl Street station, when one mile was the limit of distribution. Is it too much to expect that this new development may mean transmission of far greater blocks of power than at present; that greater distances may be covered than are now economically possible, and that thousands of miles of rural line may soon reach loads which are so light that their present-day development is impracticable?

* * * *

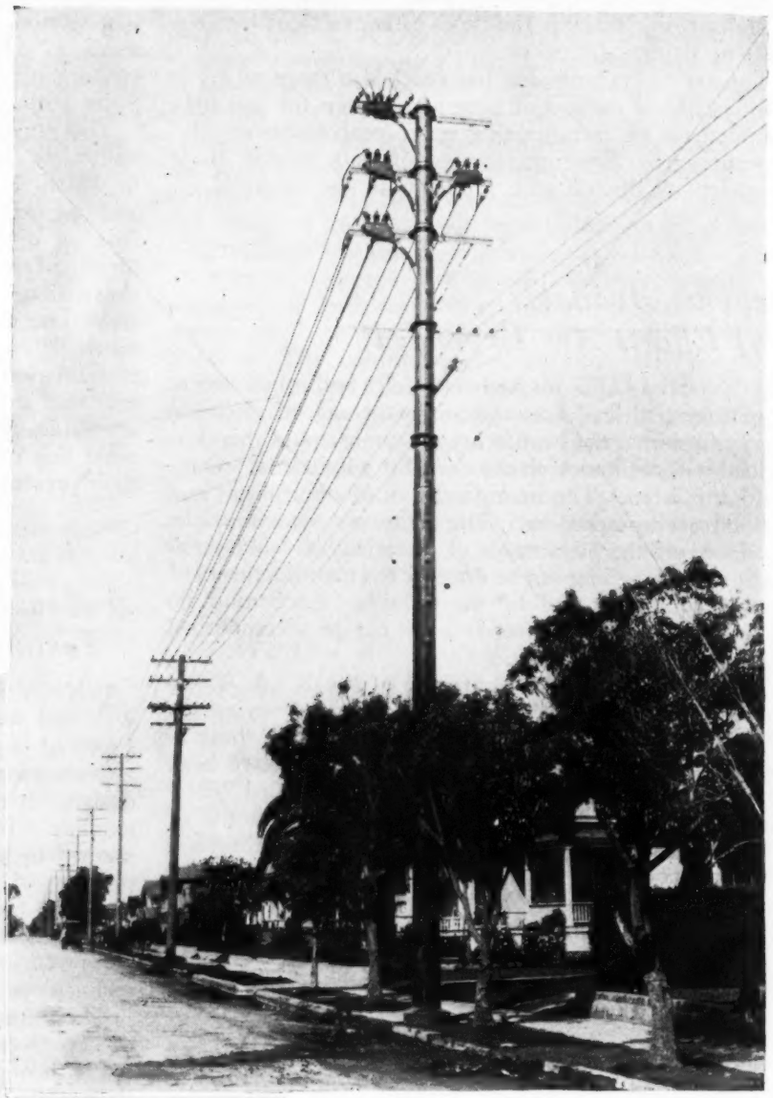
A New Hope Found in the Fixture Show

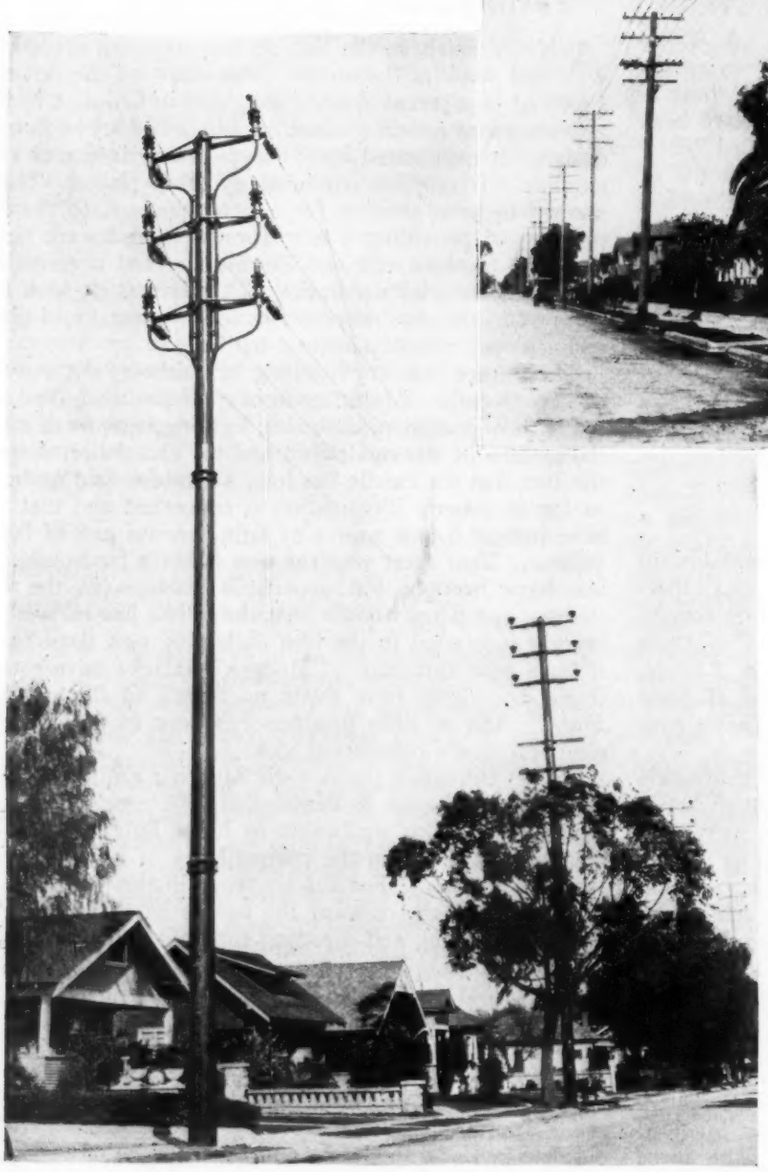
A NEW spirit in the fixture industry was evidenced last week at the annual trade show of the Artistic Lighting Equipment Association, held in Chicago, in the appearance of a new modern expression of art in fixture design. It manifested itself conspicuously in one or two exhibits. It cropped out in many other places. There seemed to be a groping for a new approach to the old problem of providing a base for the incandescent lamp that will combine efficient illumination and a contribution to the interior decoration of the home. It took the form of modernistic expressions in both metal and glass and achieved not only interest but beauty.

The fixture industry has long languished for the want of new thought. Manufacturers continued to follow the old path of tradition, designing lighting equipment after the pattern of the candelabra and the chandelier, despite the fact that the candle has long since been laid aside in so far as general illumination is concerned and that we have instead a new source of light, intense and of large volume. Year after year the new fixtures for household use have brought but superficial changes in the old themes, and what wonder that the public has refused to become interested in the idea of buying new fixtures as it buys new furniture. "Modern" fixtures have established no vogue, have made no appeal to the popular fancy. And so little progress has been made with the electrical man's refixturing idea.

In this exhibition the Artistic Lighting Equipment Association has begun to demonstrate the meaning of the word "artistic" as applicable to home lighting, and its members have shown the compatibility of art and practical illumination. For the tendency in this modern expression is clearly toward the use of glass and parchment for shading and directing the light and eliminating exposed lamps. The lingering impression, however, is the hope that the fixture designer is really at last pushing forth into the open water of creative art. No one can doubt that the industry would profit greatly from such an excursion. For if vogue in fixtures can be established so that modern fixtures look new and have a mode appeal, the public will buy them and discard the obsolete just as it modernizes its other choice possessions.

Cable Risers Concealed in This Overhead-Underground Junction





CONFRONTED with the problem of joining underground cables with overhead circuits in a residential section of Los Angeles, the Bureau of Power and Light was particu larly anxious to avoid aggra vating the public's objection to overhead lines, which would result from a nest of exposed cable risers. By using tubular poles in which the cables are concealed except where they emerge at the top it was successful in removing the objections to underground-overhead junctions at least. Some of the features of construction are presented on page 1383.

Concrete Bus-Structure Tests

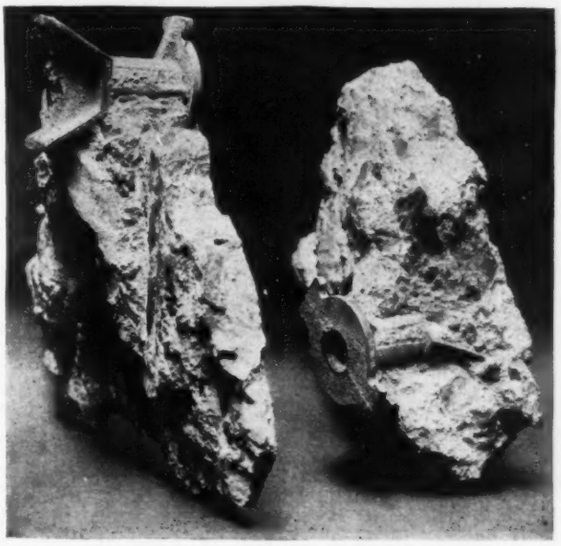
Characteristic failures of monolithic, thin-wall bus structures and supporting equipment developed in laboratory tests. Tension and compression strength values established

By WILLARD A. KATES

Engineer Day & Zimmermann Engineering & Construction Company

THE concrete cell-type bus structures which are widely used in substations and medium-capacity power plants are formed of relatively thin walls and horizontal slabs cast monolithic. Because of the thin cross-sections involved, predetermination of the mechanical strength is difficult. A "sloppy," well-puddled concrete mix is essential to assure filling the thin sections, particularly around the reinforcing steel. Even with the most thorough puddling a uniform distribution of concrete aggregates is questionable. Calculations of reinforced concrete slabs are based on definite positions for the reinforcing bars. In thin slabs a small absolute variation from the assumed position results in a large percentage change in strength. In addition, the mechanical loading due to short-circuit forces is impressed on the horizontal slabs over the restricted areas of bus support bases and the vertical compartment walls opposite these bus supports are weakened by the openings provided to permit installation and maintenance of the latter.

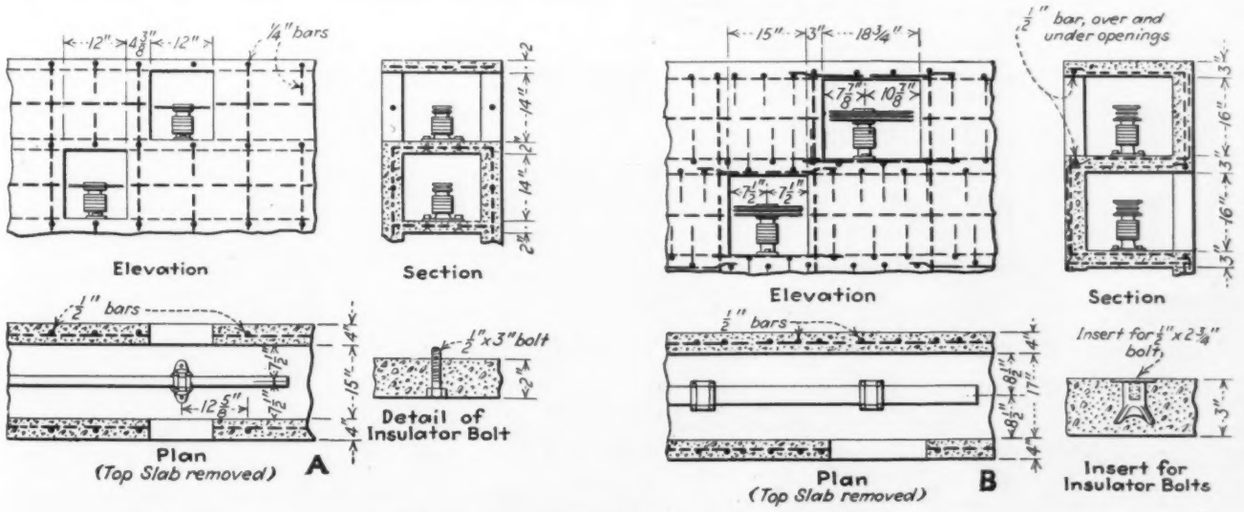
To determine the composite results of these factors and compare two designs of cell structures typical sections were constructed and subjected to mechanical loading tests. Six sections of each type of structure were cast of 1 : 1½ : 3 concrete under conditions duplicating those obtained on a construction job. The reinforcing steel was placed and the concrete poured by field construction men, as a part of a construction job. It may be noted from the illustrations that the two types of structures differed in a number of respects.



Characteristic failures of bus structures

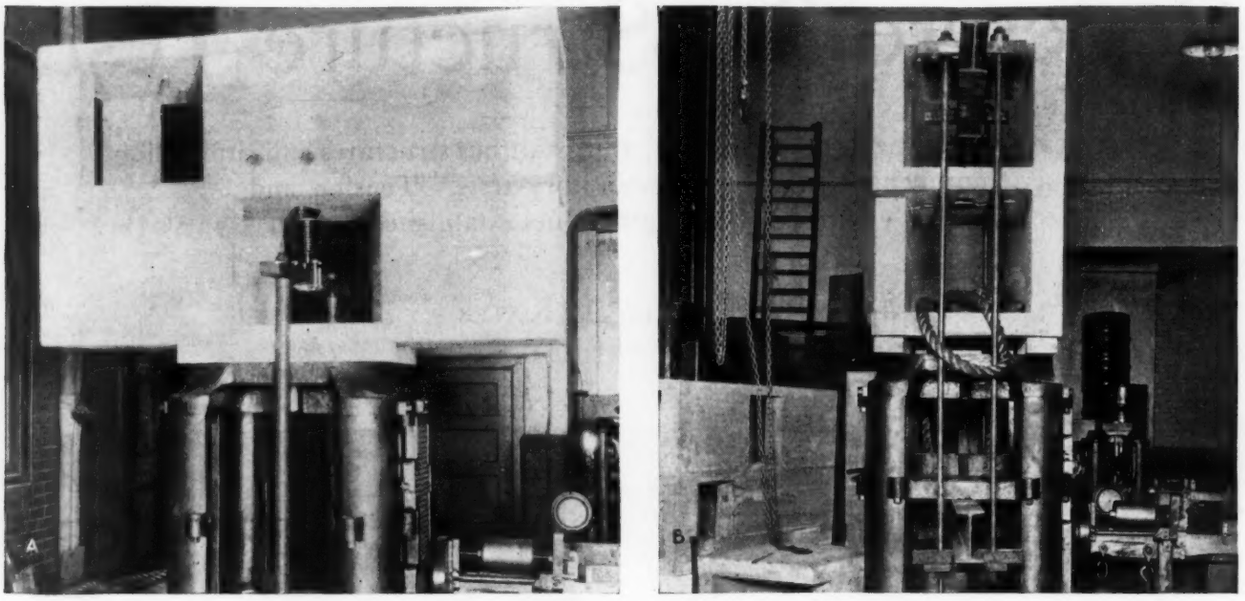
Conical failures for tension (left) and compression (right) are typical of these tests.

It was anticipated that tests of these typical sections



Sections of two types of bus structures tested

The type A sections were constructed with 2-in. horizontal slabs, whereas the type B structures were constructed with 3-in. slabs. The differences in reinforcing steel sizes and locations are shown. The bus supports of the type A structures were held by bolts extending through the horizontal slabs with heads flush with the underside of the slab. In the type B sections the bus supports were held by means of bolts screwed into concrete inserts set in the slab. The 3-in. type B slabs permitted the use of these inserts without providing a complete metallic path through the slabs. The type A compartments were equipped with bus supports having cast iron bases, while the type B compartments had malleable iron bases. The bus supports of the type A structure were set on 4-ft. 10-in. centers, whereas those in the type B structure were on 2-ft. 9¾-in. centers (max.)



(a) Type A section in tension tests. (b) Type B section under compression stress

would indicate the performance of entire structures, since the latter would consist of a succession of the test sections cast monolithic and since each section would support an identical arrangement of bus supports. It was also thought that the strength of the bottom slab of the top compartment would be typical of the two slabs below, since this slab is supported by vertical walls in the same manner as are the two lower slabs.

The application of impact to the bus support was considered as a method of test, but was abandoned in favor of slowly applied loading. While the force applied during short circuits is of the nature of an impact, the duplication of such impact was beyond the possibility of the investigation. Furthermore, progressive impact application to destruction would have produced a fatigue type of failure which would not be as informative for design purposes as failure due to slowly applied loading.

As indicated in the illustrations, the sections were supported on wooden blocks on the head of a 50,000-lb. Olsen machine. A transverse steel bar was clamped on the bus support in place of the busbars and was yoked by two steel rods to a similar bar on the movable testing head. The position of the test specimen, whether erect or inverted, was determined by the type of test desired, i.e., whether compression or tension.

The results of tension tests are summarized in Table I.

Table I—Tension Loading Tests of Concrete Bus Compartments

Test Section Number	Type	Age, Days	Breaking Load, Pounds	Approximate Size of Spalled Area, Inches	Radius in Inches from Bolt or Insert Center to Edge of Spalled Area Max.	Min.	Remarks
1	A	54	5,950	12 x 17	7	3	Breaking load preceded by load of 5,130 lb., which broke bus support base. Base replaced with steel plate and failure loading applied.
3	A	54	6,560	14 x 16	7	3	Breaking load preceded by load of 5,660 lb., which broke bus support base. Base replaced with steel plate and failure loading applied.
7	A	57	5,550	13 x 15	8	5	.....
8	A	56	5,230	11 x 15	7	4	.....
Average	..	..	5,823	.....	...	..	.....
6	B	49	12,245	18 x 21	13	5	Breaking load preceded by loads of 4,570 lb., and 5,060 lb. which broke bus support porcelain. Bus support replaced by yoke and failure loading applied.
4	B	49	12,535	18½ x 13	8	3	Breaking load preceded by load of 8,715 lb., which deformed cross bar applying load. Bar replaced and failure loading applied.
10	B	48	11,700	17 x 19	9½	4½	Compartment had spalled area on under side of horizontal slab and under bus support location. Apparently did not affect strength of specimen.
11	B	48	10,670	15½ x 16	8½	6	.....
Average	..	..	11,788	.....	...	..	.....

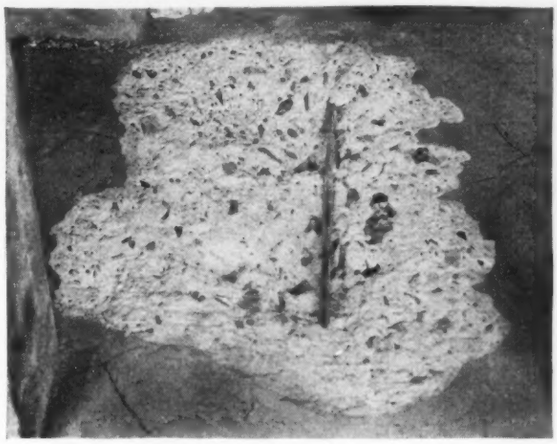
Table II—Compression Loading Tests of Concrete Bus Compartments

Test Section Number	Type	Age, Days	Breaking Load, Pounds	Approximate Size of Spalled Area, Inches	Radius in Inches from Bolt or Insert Center to Edge of Spalled Area Max.	Min.	Remarks
2	A	55	14,015	13 x 17	10	3	Breaking load was preceded by loads of 10,095 lb. and 11,095 lb., which resulted in bus support failures. Bus supports replaced by steel plate of same contour as bus support base and failure loading applied. Slight cracking radially.
9	A	56	11,610	15 x 18½	10	8½	Radial cracking in slab and side walls.
Average	..	..	12,813	.....	...	..	.....
5	B	50	23,550	16½ x 19	10	6	Breaking load was preceded by a load of 21,415 lb., which resulted in deformation of cross bar applying load. Bar replaced and failure loading applied.
12	B	51	19,420	17 x 21	12	9	.....
Average	..	..	21,485	.....	...	..	.....

The tests of type A sections were featured by the failure of the cast-iron bases of the bus supports. It was not possible to develop the strength of the bolts as set in the slab by pulling the bus support and a heavy steel plate was therefore substituted to permit failure loading of the concrete. Typical shear and spalling and the pulling out of the bolts are shown in the accompanying illustration.

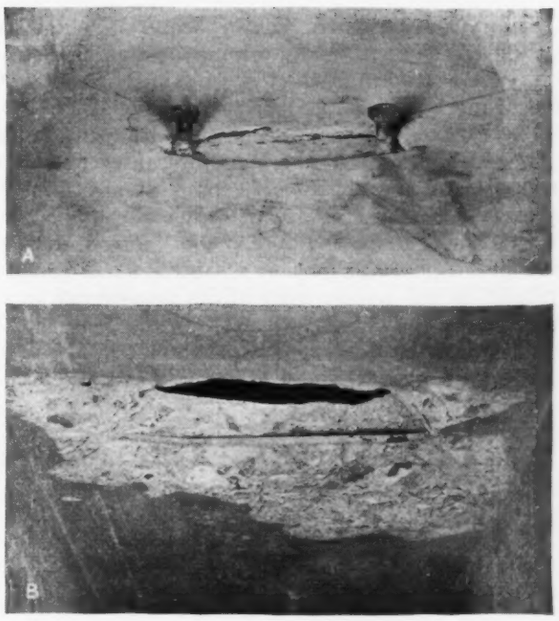
The bus supports of the type B specimens were also insufficient to pull out the inserts, but their failure occurred in the porcelain. They were replaced with a steel plate for continuance of tests. Failures of the concrete section then occurred by fracture over a conical surface.

Compression test results are summarized in Table II. Here also the cast-iron bases of the type A bus supports proved inadequate to distribute the load properly from



Typical tension failure
Note cavities in bolt positions

porcelain to concrete. The deformation of the latter resulted in the breaking of two cast bases, and further tests were made by applying the load to the concrete on a steel plate having the same shape and area as the casting. Under such compression loading the type A specimens developed a failure accompanied by radial cracks in the horizontal slab. One test section developed cracking of the side walls, being the only specimen to do so in either tension or compression tests.

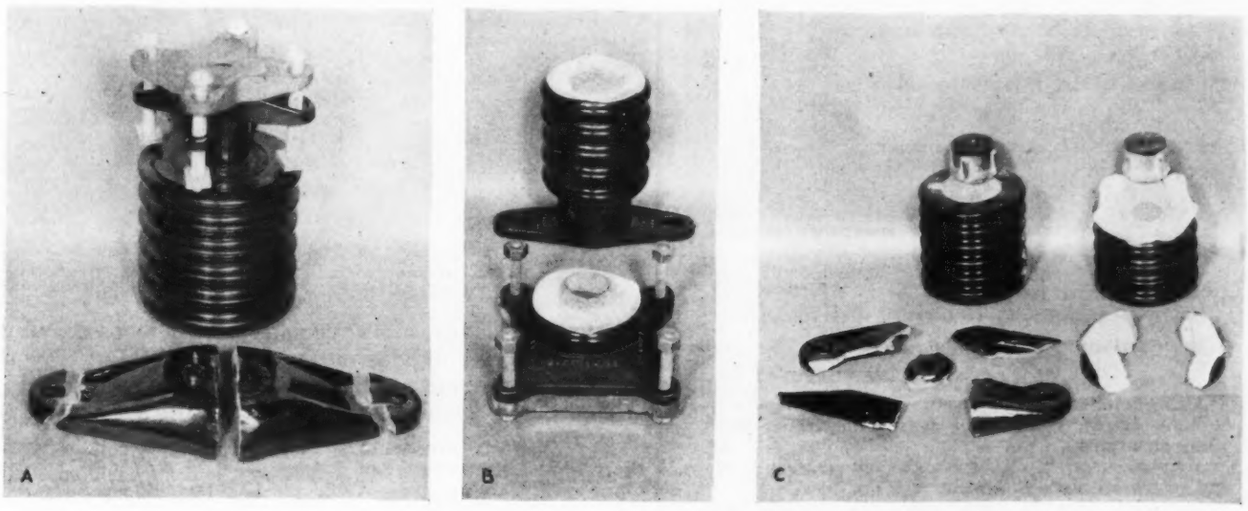


Typical compression failure
Conical failure is characteristic—(a) shows failure from above, (b) from below.

The type B bus supports withstood compression loading to failure of the type B test specimens, the only distress shown being a deformation of the base to conform to the contour of the bending of the concrete slab. Such deformation is of benefit rather than harm, for it results in the applied load being distributed over the area of the base. Failure of the concrete occurred by fracture over a truncated conical surface tapering out from the edge of the bus support base.

Comparison and review of these tests show the following prominent features:

1. All concrete was of good quality and there was much shear through the coarser aggregate. There was no relation apparent between the area of the spalled section and the ultimate strength of the test section. The amount of spalling was probably limited in many cases by the reinforcing steel and the vertical walls of the specimen.



Iron bus support failures
(a) Base casting failure in tension type A support. (b) Insulator failed in tension type B support. (c) Compression destruction of type A support.

2. The type B structure, having 3-in. horizontal slabs and using bolt inserts, is approximately twice as strong as the type A structure, which is of 2-in. horizontal slab section, using bolts set in concrete.

3. The type A design was of better balance than the type B. Any interphase short circuit causes tension on the supports of one phase. The limit of any design is therefore the tensile strength of either the bus support or its attachment to the concrete. The failure load of the type A bus support in tension is of the same order of magnitude as the failure load of its attachment to the concrete.

A much heavier bus support of more than twice the strength of the type B could be used in the type B bus structure with resultant better balance of design for the structure as a unit.

4. Failure in either type of structure due to mechanical loading of the bus supports would probably not result in failure of the side walls of the structure. Spalling and cracking of the concrete were, in all instances save one, confined to the horizontal slabs.

5. As a corollary, the cast-iron bus support bases were much inferior to the design of malleable iron, both in tension and compression loading. This fact was further checked by placing a support with cast-iron base on the smooth bed of the testing machine and loading it in compression.

In three such trials the bases broke at 17,250, 14,900 and 14,400 lb. Similar test of a type B support with malleable base produced no distress under loading of 50,000 lb.

Modern Elevators

PRESENT tendencies in elevator design are directed toward higher intensity of service, higher quality of service, improved safety or better economy, although most improvements involve several of the desired qualities.

Higher intensity of service has been secured by:

New control systems using multi-voltage operation.

Joint operation of two elevators in up and down service.

Car position indicator exposing floor numbers successively.

Higher quality of service has been secured by:

Gearless instead of geared machines.

Automatic scheduling device to signal operators starting from terminals.

Automatic spacing device to minimize stops per car.

Improved safety has been secured by:

Tied-down compensator frames, which eliminate slack formation in cables under emergency stopping conditions.

Institution of slow-speed zone, automatically controlled at terminal landings.

Improved safety gates, eliminating shearing hazards.

Better economy in manufacture has been secured by:

Main-motor-micro for speed control during self-leveling period, eliminating large quantities of auxiliary apparatus.

Micro-selector in machine room, eliminating leveling switch on car and cams at each floor.

Improved door hangers, minimizing friction and clearances.

Computing Compensator Settings for Automatic Voltage Regulators

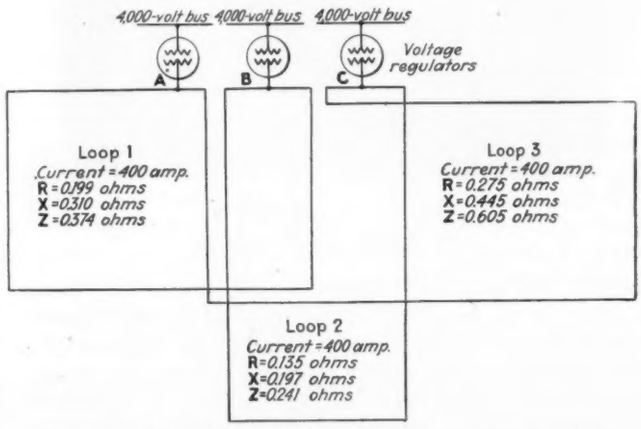
FOURTH ARTICLE

By V. W. Palen

TRIPLE LOOP CIRCUITS.—The procedure outlined in previous articles for single-feed, single-loop and double-loop circuits has been tested in everyday practice and found satisfactory. For a triple loop a similar procedure may be followed. As with the other loop circuits the calculations would net a set of values thus:

Loop 1	Resistance	drop = 3.98 volts
	Reactance	drop = 6.2 volts
	Impedance	drop = 7.48 volts
Loop 2	Resistance	drop = 2.70 volts
	Reactance	drop = 3.94 volts
	Impedance	drop = 4.82 volts
Loop 3	Resistance	drop = 5.50 volts
	Reactance	drop = 8.90 volts
	Impedance	drop = 12.10 volts

An examination of the accompanying illustration will disclose that *A* compensator and regulator regulate the



Triple circuit assumed for illustrative calculations

voltage on half of loops 1 and 3. Therefore, the settings on the compensator on *A* regulator will be set for the average voltage drops for loops 1 and 3 thus:

IR = (average of 3.98 and 5.50) = 4.74 volts
IX = (average of 6.2 and 8.90) = 7.55 volts
IZ = (average of 7.48 and 12.10) = 9.79 volts

Also, *B* regulators regulate half of loops 1 and 2. Therefore, the settings on the compensators on *B* regulators will be set for the average voltage drops for loops 1 and 2 thus:

IR = (average of 3.98 and 2.70) = 3.34 volts
IX = (average of 6.2 and 3.94) = 5.07 volts
IZ = (average of 7.48 and 4.82) = 6.15 volts

Finally, *C* regulators regulate half of loops 2 and 3. Therefore, the settings on the compensators on *C* regulators will be set for the average voltage drops for loops 2 and 3 thus:

IR = (average of 2.70 and 5.50) = 4.10 volts
IX = (average of 3.94 and 8.90) = 6.42 volts
IZ = (average of 4.82 and 12.10) = 8.46 volts

The various types of compensators and setting methods will be covered in the next and final article of this series.

Tubular-Steel Poles for Cable Risers

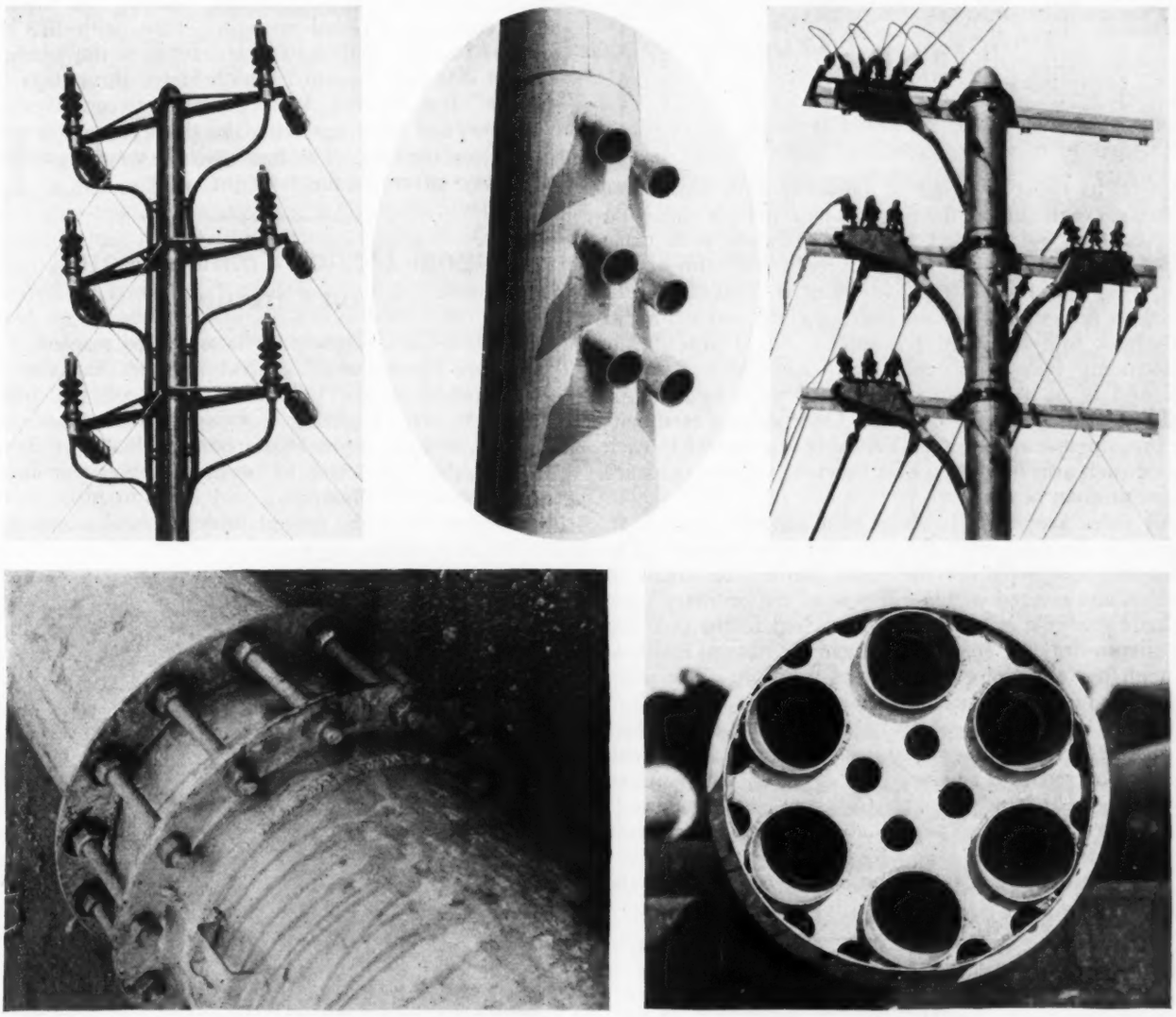
By C. H. Jenkins
Underground Engineer
Bureau of Power and Light, Los Angeles, Calif.

WOOD poles for cable terminal risers to overhead lines have been the source of considerable trouble and expense, due to the pole igniting when a ground occurs on a circuit at this point. Latticed steel poles with cable pipes placed inside the structure frequently have been used. They provide ample strength and are free from fire hazard, but can easily be climbed by unauthorized persons. Furthermore, the exposed conduits are rather unsightly in appearance.

Rapid increase in the number and size of distribution circuits has made it necessary to substitute some pole material which will not burn, yet will provide suitable strength and present a satisfactory appearance on the street. Believing that a tubular steel pole with cable pipes installed within the pole would best meet the requirements for strength, durability and appearance, the Bureau of Power and Light of the city of Los Angeles has purchased several taper-tube poles made by the Taper Tube Pole Company of San Francisco and erected them at cable terminals adjacent to a new class "A" distribution substation.

This station will have an ultimate capacity of 31 primary feeders, twenty street-lighting circuits and twelve 33-kv. incoming and "peddler" lines. Three-conductor, 500,000-circ.mil, 5-kv. cable is used for primary feeders, four-conductor, No. 6, 5-kv. cable for street lighting circuits, three-conductor, 400,000-circ.mil, 33-kv. cable for conduit runs and 500,000-circ.mil, single-conductor cable for cable-pole risers for the high-tension lines. The three single-conductor, 33-kv. cables are placed in one 6-in. conduit riser to reduce sheath current and voltage.

The tubular steel poles are made of No. 10 gage sheet-steel rolled into taper tubular form and butt-welded. A No. 10 gage sheet-steel diaphragm is welded to the tube near each end of all sections to hold the cable pipes



Details of tubular pole construction for overhead-underground junctions

The pothead-to-line-conductor construction for two 33,000-volt circuits and for four feeders from a single pole is illustrated in the upper views, as are the details of the pole base through which cables are conveyed to conduit lines. The method of joining pole sections is also illustrated, as is the arrangement of cable conduits within the pole with steel diaphragm support.

rigidly in position and stiffen the pole against crushing strains. At one end of each section the cable pipes are provided with loose couplings for alignment. The poles are made in sections which are swedged together in socket formation and held rigidly by ¾-in. bolts between the flanges. The method of taking out the six 3½-in. cable pipes with 4-ft. radius bend for connecting to the conduit line at the pole base is shown.

An angle bar bent in "U" form is welded to the pole for crossarm support. Three classes of crossarm are provided, as follows: No. 1, designed for dead-ending six conductors, each with 1,800-lb. pull and of sufficient

Pole No.	No. of Sections	Outside Butt Dia., In.	Outside Top Dia., In.	Length	Cable Pipes Inside Dia., In.	Cable Pipes No.	Crossarms No. 1	Crossarms No. 2	Crossarms No. 3
1	4	19¾	12	82 ft. 3 in.	3½	6	3	6	3
2	3	17½	12	61 ft. 3 in.	3½	6	3	2	..
3	3	18½	12	70 ft. 3 in.	3½	6	3	1	3
4	3	18¾	12	72 ft. 3 in.	6	2	..	1	3
5	4	20	12	84 ft. 3 in.	6	2	..	6	3
6	2	16¼	12	54 ft. 3 in.	3½	6	3	..	..

strength to resist twisting or buckling with two wires broken on each side of the pole. The arms are placed on 4-ft. centers and support flat-type potheads with cable outlet at an angle of 45 deg. A pole with three such crossarms and four circuits in place is shown. No. 2 crossarm is designed for supporting eight conductors in both buck and line arm positions. No. 3 arm is for dead-ending two 33-kv. conductors each with 1,500-lb. pull and is of sufficient strength to resist twisting or buckling with one wire broken. One pothead terminating one single-conductor, 33-kv. cable is attached to each end of each arm by means of a bracket. These arms are placed on 6-ft. centers.

All poles are set 8 ft. deep in a concrete base 1 ft. greater in diameter than the pole and 6 in. deeper. The poles are assembled in the yard, hauled by truck to location and erected with a gin pole of the ordinary type. A short gin pole is temporarily attached to the pole top to assist in drawing riser cables from the nearest manhole through the cable pipes to pothead position. The poles are head-guyed in the usual manner.

Double hot process galvanizing is applied to all poles at the factory and after erection they are painted with one coat of red lead and one coat of green pole paint to harmonize with tree foliage. A spun copper acorn is attached to the pole top to exclude moisture and provide ornamentation.

Specifications for several types of poles are given in the accompanying table.

Restoring Service from Flooded Generators

By William Wallet
Electrical Department, Vermont Marble Company, Proctor, Vt.

THE Proctor hydro-electric station of this company presented the chief problem in service restoration when flooded last fall. The plant contains one 1,600-kw. and three 750-kw. vertical units generating at 280 volts and operating under a head of 120 ft. Following the subsidence of the flood it was found that the generating units and switchboard were almost covered with waste marble, sand and gravel. Twenty-five men worked more than three days to clear the first floor, after which a space in the cellar was cleared sufficiently to permit the installation of a large hot-air furnace built with three pipe outlets and a motor-driven fan to speed up air circulation.

Each generating unit was taken apart and the parts cleaned from sand and grit, after which it was reassembled and a temporary housing built over it to hold the heat, hot air then being circulated from the furnace piping through the under side of the machine and thence through the windings. The machine was then started, but not built up to generate. After running it 24 hours it was shut down, the temporary wooden housing set to one side and the machine blown out with compressed air at about 80 lb. pressure. The temporary house was again placed over the machine and the generator leads short-circuited at the switchboard, starting the machine and circulating full-load current. This, with the heat from the furnace, built up a temperature on the windings of about 200 deg. F., which was held for three days. A "megger" test showed 35 megohms between windings and frame, and after removing the short circuit the units were put on the line. The first machine went on the line twelve days after the flood hit the plant.

Signal Device Promotes Safety on Circuits

AN INSULATED detachable cover to prevent premature operation of control switches has recently been installed at the generating plant of the Salem (Mass.) Electric Lighting Company. It consists of a bakelite box with rubber extensions and slotted design which enables the device to be slipped over the switch control button, as illustrated, and hung in place as desired. Covers used to protect lines whose disconnecting

Device hung over control switch buttons warns against operation

switches are open or whose conductors have been grounded are painted red and those used to remind the operator that a particular switch is to be opened only after removal of the cover are painted gray. Suitable printed and symbolic designations are carried on the covers as desired. These signal devices have been patented by Allen J. Ryno, chief operator of the Salem company, and are manufactured by the States Company, Hartford, Conn.

Effect of

Sudden Loss of Load

Voltage and frequency conditions following the sudden dropping of load on 20,000-kva. hydraulic-driven generator. Voltage may reach values detrimental to machine insulation

By C. B. HAWKINS*, S. MURRAY JONES† and O. E. CHARLTON†

TO DETERMINE the increase in voltage and speed when full load is suddenly dropped from a generator and to obtain data on the operation of an overvoltage overfrequency relay, tests were recently made by the Alabama Power Company at its Mitchell Dam plant, on the Coosa River. The overvoltage overfrequency relay used was designed to open the main field circuit and the low-tension breaker when the speed and voltage had increased to some predetermined value.

In all the tests, shown in Figs. 2 to 18 and Table I, the generator was made to carry full load at some predetermined power factor and then the load was dropped by opening either the high-tension or the low-tension breaker, depending upon the particular test being made. A six-element oscillograph recorded the increase in voltage and speed resulting from the sudden decrease in load, as well as other information pertinent to the object in view. A number of tests were made before the overvoltage overfrequency relay was put in service, giving some idea of the maximum voltage to be expected under the worst conditions (Figs. 2 to 12). The relay was then connected and the tests repeated (Figs. 13 to 18). By comparing the results of the two series of tests the effects of the relay were clearly shown.

After analyzing the results of these tests the following conclusions were formed:

1. When a generator suddenly drops its load, there is an accompanying rise in voltage, which at times may attain values sufficiently high to affect the insulation of the connected apparatus.

2. The present voltage regulator reduces the overvoltage somewhat, but is not able to prevent the voltage from rising to excessive values.

3. The power factor of the load has little effect on the total increase in voltage, but it does affect the rate of increase. When the load of low power factor is dropped from the generator, the rise in voltage will be more rapid than an equal load of higher power factor.

4. When power transformers are connected to the generator, the magnetizing current constitutes a load on the machine and tends to hold the voltage down, though this effect is not very pronounced.

5. The overvoltage overfrequency relay used did not function sufficiently fast to prevent the voltage from rising to values that might prove destructive to insulation. It was found that certain refinements in setting the relay were possible, but were unknown at the time of these tests. These refinements would probably have made the relay more definite in operation. Further tests are to be made some time in the future to clear up these points.

To obtain a complete record of the principal factors contributing to the above conclusions, tests were made under the following conditions: (*a*) Voltage regulator in service, (*b*) voltage regulator out of service, (*c*) load dropped by tripping the low-tension breaker, (*d*) load dropped by tripping the high-tension breaker and (*e*) power factor of load changed. After analyzing the results obtained from these tests, an overvoltage overfrequency relay was connected to the generator and the tests were repeated. The relay used was not a standard product, but an experimental piece of apparatus consisting of a combination of a frequency relay and an overvoltage relay. The contacts of these relays were in series, so both had to be closed before the auxiliary relay could open the generator field circuit. In the test shown in Fig. 17 the relay was operated by the overfrequency element only, whereas that shown in Fig. 18 was operated by the overvoltage element only. The relays were set to operate on 25 per cent overvoltage and 8 per cent overspeed.

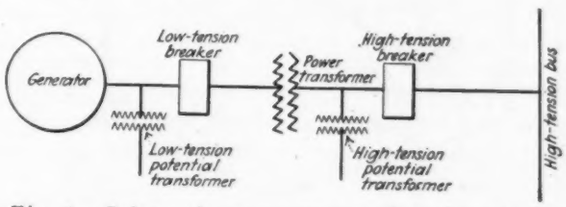


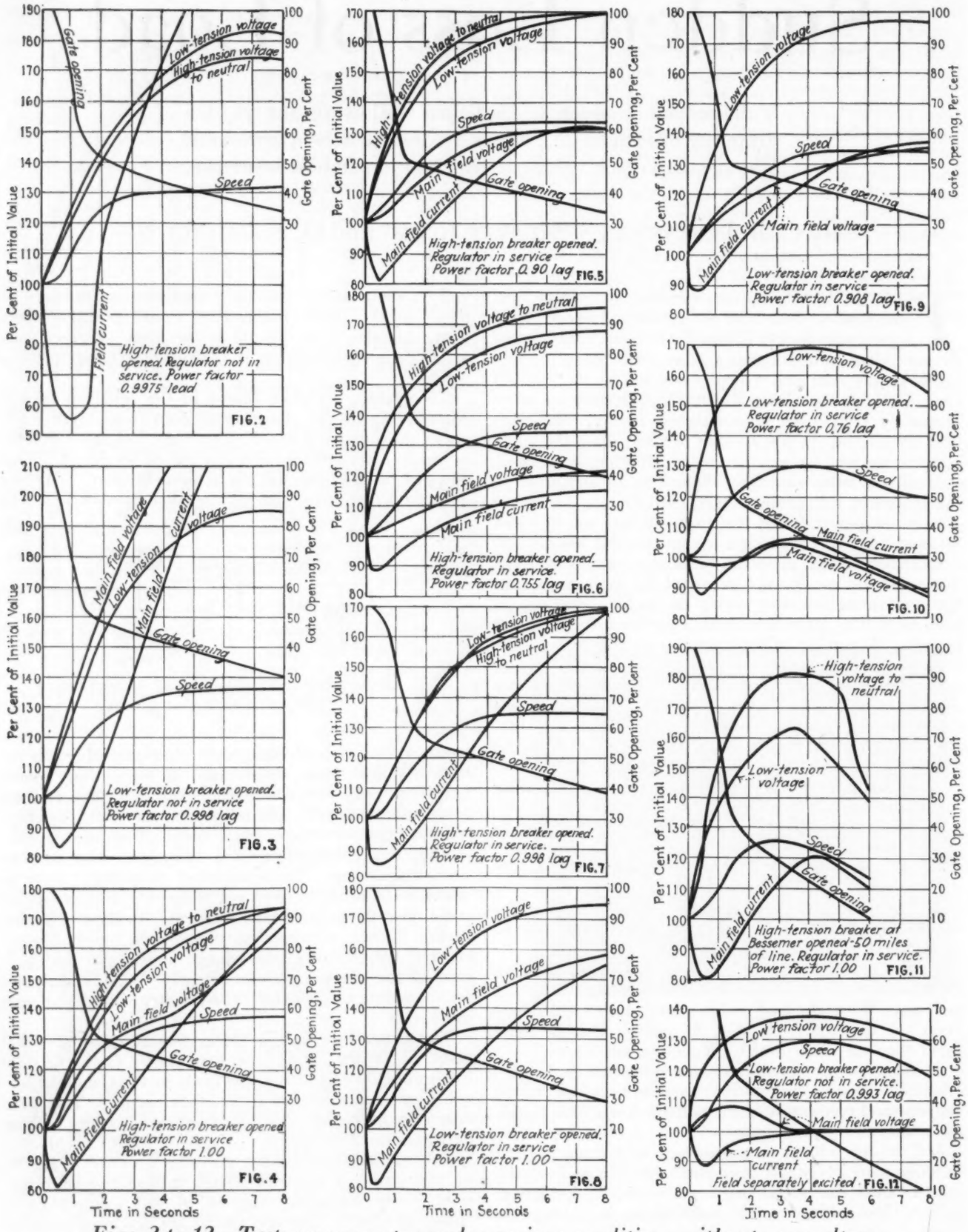
Fig. 1—Schematic arrangement of equipment for overvoltage overfrequency tests

The generator used in these tests is rated at 6,600 volts, 17,500 kw., at 87.5 per cent power factor (20,000 kva.) and 100 r.p.m., and was made by the General Electric Company with direct-connected exciter. This generator is driven by a 24,000-hp. Allis-Chalmers turbine designed for 100 r.p.m. at a head of 70 ft. and is controlled by an Allis-Chalmers governor operated at 180 lb. oil pressure. A standard Tirrill voltage regulator was used. The schematic diagram of test connections is shown in Fig. 1. The test results are described in detail as follows:

Effect of the Magnetizing Current of Power Trans-

*Alabama Power Company.
†Southeastern Engineering Company.

formers.—The maximum voltage obtained when the load is suddenly dropped from the generator depends somewhat on which oil switch operates. If the high-tension switch interrupts the load, the power transformers are left connected to the machine and the magnetizing current of these transformers becomes a load on the generator. The generator field current increases very rapidly as the impressed voltage increases. The reac-


Per Cent of Initial Value
Gate Opening, Per Cent
Time in Seconds
Gate opening
Low-tension voltage
High-tension voltage to neutral
Speed
Field current
High-tension breaker opened. Regulator not in service. Power factor 0.9975 lead
FIG. 2
Main field voltage
Low-tension current
Main field
Low-tension breaker opened. Regulator not in service Power factor 0.998 lag
FIG. 3
Main field current
High-tension breaker opened Regulator in service Power factor 1.00
FIG. 4
High-tension breaker opened. Regulator in service. Power factor 0.90 lag
FIG. 5
High-tension breaker opened. Regulator in service. Power factor 0.755 lag
FIG. 6
High-tension breaker opened. Regulator in service. Power factor 0.998 lag
FIG. 7
Low-tension breaker opened. Regulator in service Power factor 1.00
FIG. 8
Low-tension breaker opened. Regulator in service Power factor 0.908 lag
FIG. 9
Low-tension breaker opened. Regulator in service Power factor 0.76 lag
FIG. 10
High-tension voltage to neutral
High-tension breaker at Bessemer opened 50 miles of line. Regulator in service. Power factor 1.00
FIG. 11
Low tension voltage
Low-tension breaker opened. Regulator not in service. Power factor 0.993 lag
Field separately excited
FIG. 12

Figs. 2 to 12—Tests on generator under various conditions without overvoltage overfrequency relay in service

TABLE I—INITIAL VALUES FOR OVERVOLTAGE OVERFREQUENCY TESTS

Figure Nos.	Load on Generator, Kw.	Power Factor, Per Cent	Low-Tension Voltage	High-Tension Voltage	Main Field Voltage	Current in Main Field, Amp.	Speed, R.p.m.
Fig. 2	17,640	99.75 lead	6,660	64,500	111	330	100
Fig. 3	17,700	99.8 lag	6,150	.....	120	335	100
Fig. 4	17,700	100	6,234	64,500	121	337.5	100
Fig. 5	17,460	90 lag	6,480	65,000	161	455	100
Fig. 6	17,460	75.5 lag	6,750	66,000	121	580	100
Fig. 7	17,700	99.8 lag	6,270	.....	126	360	100
Fig. 8	17,650	100	6,150	.....	120	335	100
Fig. 9	17,460	90.8 lag	6,420	.....	160	445	100
Fig. 10	17,460	76 lag	6,630	.....	205	580	100
Fig. 11	17,460	100	6,210	64,000	122	337.5	100
Fig. 12	17,650	99.3 lag	6,216	.....	127	360	100
Fig. 13	17,460	99.8 lag	6,420	.....	...	352.5	100
Fig. 14	17,220	76.5 lag	6,870	.....	...	600	100
Fig. 15	17,460	100	6,420	66,000	...	342.5	100
Fig. 16	17,300	75.5 lag	6,840	66,300	...	600	100
Fig. 17	17,500	100	6,420	.....	...	250	100
Fig. 18	17,350	100	6,390	.....	...	350	100

TABLE II—EFFECT OF MAGNETIZING CURRENT OF POWER TRANSFORMERS

	Transformers	
	With Fig. 2	Without Fig. 3
Load dropped, kw	17,640	17,700
Power factor, per cent	99.75 lead	99.8 lag
Increase in low-tension voltage, per cent	183	195
Maximum low-tension voltage	12,200	12,000

tion of the lagging current flowing through the generator armature tends to decrease the generator field flux somewhat and consequently to prevent the terminal voltage from rising as high as when the machine is operating at a higher lagging or a leading power factor.

The voltage rise expressed in per cent of the initial voltage, with and without the power transformers connected to the generator, is shown respectively in Figs. 2 and 3. The maximum voltage increase in each test is given in Table II. The increase in voltage as expressed in per cent of the initial value is greater when the power transformers are not connected to the generator. The reason the maximum voltages are about the same is that in the test shown in Fig. 2 the initial voltage was higher than that of the Fig. 3 test.

Effect of Voltage Regulator.—By comparing the curves shown in Figs. 2 and 4 and also Figs. 3 and 8 it becomes apparent that the voltage regulator does reduce the overvoltage to some extent, the per cent voltage rise with the regulator in service being less than when it is disconnected, but the curves show that the regulator alone is incapable of holding the voltage down to reasonable limits. In Fig. 3, which shows a condition in which the regulator was out of service and the current and voltage of the generator field increased approximately 150 per cent over the initial values, it would seem that the low-tension alternating-current voltage should have increased in proportion. The reason it did not is, of course, due to the generator field becoming saturated. The maximum values reached are shown in Table III. In each case, whether the high-tension or the low-tension breaker was tripped, the voltage increase in per cent of initial value was greater when the regulator was not in service. As before, the initial voltages were somewhat different, so the maximum voltages reached cannot be compared on an equal basis.

Effect of Load Power Factor on Voltage Increase.—Loads with low lagging power factor require stronger field excitation on the generator than high power factor loads. If the circuit is opened when the generator is carrying load at low lagging power factor, the rate of increase of the voltage will be greater than if an equal load of higher power factor were dropped. The effect of different power factors can be seen by comparing the curves for the tests shown in Figs. 4, 5 and 6, where the high-tension breaker was tripped, or in Figs. 8, 9 and 10, where the low-tension breaker interrupted the load. These data are compared in Table IV, which clearly indicates that the maximum value of the voltage increase is not affected very much by the power factor, but that the rate at which the voltage rises becomes greater as the power factor decreases.

Effect of a Transmission Line Connected to Generator.—The test shown in Fig. 11 was made by dropping the load from the generator under test at the Bessemer substation, leaving about 50 miles of transmission line connected to the machine. The curves show a very rapid increase in voltage and also a large maximum value. The voltage was prevented from reaching higher values because of the lightning arresters at Mitchell Dam discharging to ground. It should be noted that in this test the maximum speed was only 25 per cent above normal and this would tend to hold the voltage down, as the voltage varies approximately as the square of the speed. The high voltage reached in this test is partly produced by the charging current of the line, which is about 90 deg. ahead of the voltage, flowing through the reactance of the power transformers. This leading current at a low power factor gives a voltage rise through the transformer instead of the customary voltage drop which results from a lagging current.

Separate Excitation.—One test was made with the generator separately excited and without voltage regulation in service, the results being given in Fig. 12. It is obvious that under this condition the voltage increase is negligible, attaining a maximum of 138 per cent of the initial value. It is interesting to note in this connection that the voltage is approximately proportional to the speed of the generator, whereas with the direct-connected exciter the rise in voltage becomes approximately proportional to the square of the speed.

Transients in the Generator Field Current.—In all of the tests described above the generator field current was included on the oscillogram and from these records the

TABLE III—EFFECT OF VOLTAGE REGULATORS ON MAXIMUM VOLTAGES REACHED

	High-Tension Breaker Tripped		Low-Tension Breaker Tripped	
	Without Regulator Fig. 2	With Regulator Fig. 4	Without Regulator Fig. 3	With Regulator Fig. 8
Load dropped, kw	17,640	17,700	17,700	17,650
Power factor, per cent	99.75 lead	100	99.8 lag	100
Increase in low-tension voltage, per cent	183	173	195	175
Increase in high-tension voltage, per cent	174	174	.....	.....
Maximum low-tension voltage	12,200	10,800	12,000	10,770
Maximum high-tension voltage	194,000	194,500	.....	.....

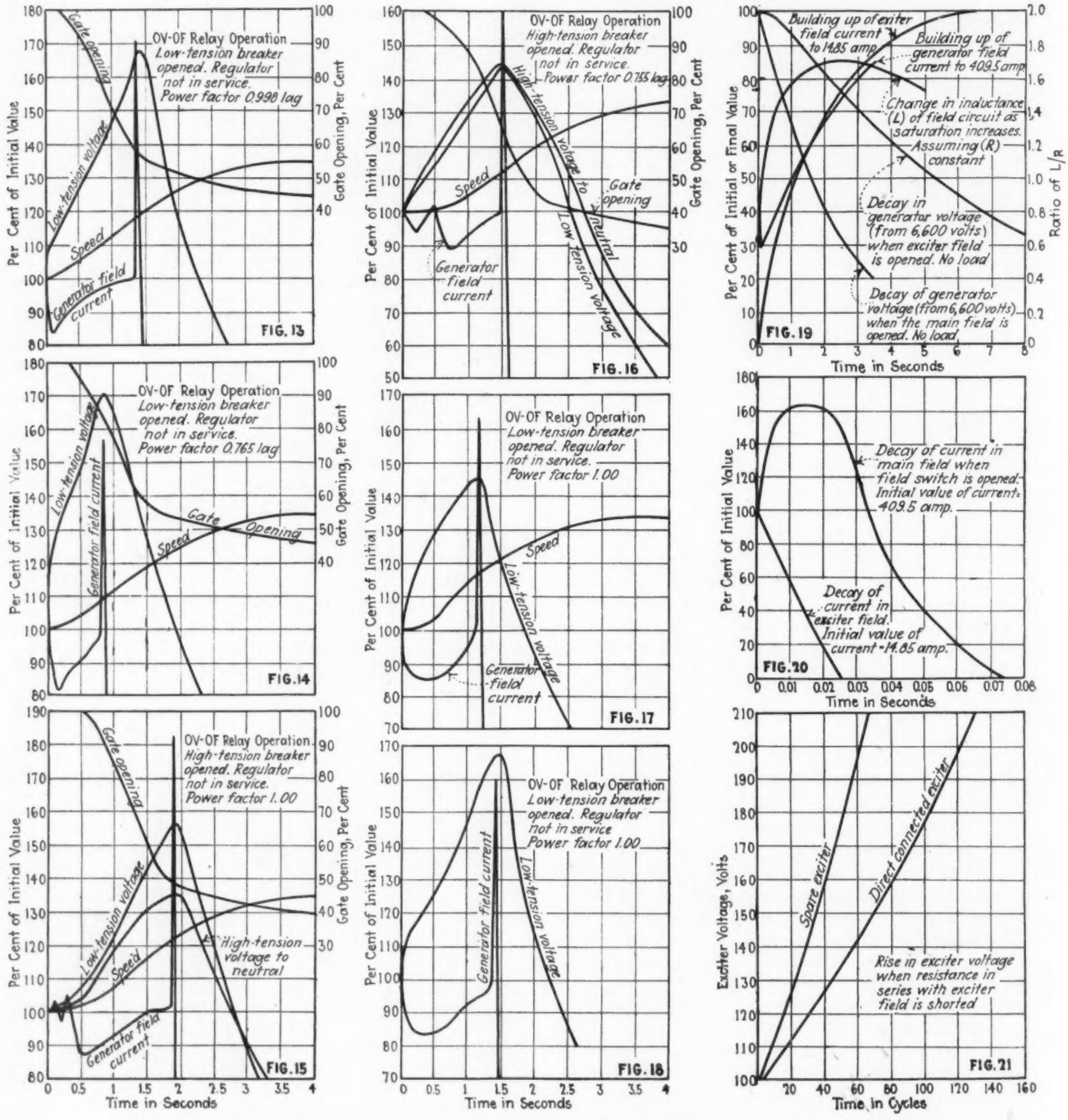
TABLE IV—EFFECT OF POWER FACTOR ON VOLTAGE INCREASE

	High-Tension Breaker Tripped			Low-Tension Breaker Tripped		
	Fig. 4	Fig. 5	Fig. 6	Fig. 8	Fig. 9	Fig. 10
Load dropped, kw	17,000	17,460	17,460	17,650	17,460	17,460
Power factor, per cent	100	90*	75.5*	100	90.8*	76*
Increase in low-tension voltage, per cent	173	170	168	175	177	169
Increase in high-tension voltage, per cent	174	170	175	.....	.....	.....
Maximum low-tension voltage	10,800	11,000	11,350	10,770	11,350	11,200
Maximum high-tension voltage	194,500	191,500	200,000	.....	.....	.....
Increase of voltage at end of one second, per cent:						
Low-tension	120	128	133	130	136	148.5
High-tension	123.5	133	142	.....	.....	.....

*Lag.

curves of the field current against time were plotted, these being included on Figs. 2 to 12 inclusive. A transient in the generator field must of necessity follow a sudden decrease in the generator load. The reason is as follows: In the steady state condition there is a certain air gap flux in the machine corresponding to a given load and a necessary amount of ampere turns or magnetomotive force in the field to force the flux through the magnetic path and to overcome the armature reaction due to the load current in the armature. The current in the armature suddenly decreases to zero when the load is dropped and consequently the armature reaction disappears. If we assume that the flux in the air gap cannot change suddenly (and such an assumption is not greatly in error), it becomes evident that the field magnetomotive force must decrease by an amount equal to the armature reaction expressed in ampere-turns. The only way for this to take place is for the current in the generator field to decrease. After a short interval of time the air gap flux begins to change and a new state of equilibrium is established.

Operation of the Governor in Closing the Turbine Gates.—In order to determine the rapidity with which the governor closed the gates a resistance unit with a sliding contact was connected mechanically to the piston rod that operates the gates. By impressing a voltage on this resistance it was possible to record on the oscillograph film the position of the piston at any time after


OV-OF Relay Operation
Low-tension breaker opened. Regulator not in service. Power factor 0.998 lag
Gate opening
Low-tension voltage
Speed
Generator field current
FIG. 13
OV-OF Relay Operation
High-tension breaker opened. Regulator not in service. Power factor 0.765 lag
High-tension voltage to neutral
Speed
Gate opening
Low-tension voltage
Generator field current
FIG. 16
Building up of exciter field current to 1485 amp.
Building up of generator field current to 409.5 amp.
Change in inductance (L) of field circuit as saturation increases. Assuming (R) constant
Decay in generator voltage (from 6,600 volts) when exciter field is opened. No load
Decay of generator voltage (from 6,600 volts) when the main field is opened. No load
FIG. 19
Per Cent of Initial or Final Value
Ratio of L/R
Time in Seconds
OV-OF Relay Operation
Low-tension breaker opened. Regulator not in service. Power factor 0.765 lag
Low-tension voltage
Generator field current
Gate opening
Speed
FIG. 14
OV-OF Relay Operation
Low-tension breaker opened. Regulator not in service. Power factor 1.00
Speed
Low-tension voltage
Generator field current
FIG. 17
Decay of current in main field when field switch is opened. Initial value of current = 409.5 amp.
Decay of current in exciter field. Initial value of current = 14.85 amp.
FIG. 20
Time in Seconds
OV-OF Relay Operation
High-tension breaker opened. Regulator not in service. Power factor 1.00
Gate opening
Low-tension voltage
Speed
High-tension voltage to neutral
Generator field current
FIG. 15
OV-OF Relay Operation
Low-tension breaker opened. Regulator not in service Power factor 1.00
Generator field current
Low-tension voltage
FIG. 18
Exciter Voltage, Volts
Spare exciter
Direct connected exciter
Rise in exciter voltage when resistance in series with exciter field is shorted
FIG. 21
Time in Cycles
Per Cent of Initial Value
Gate Opening, Per Cent

Figs. 13 to 21—Tests on generator under various conditions with overvoltage overfrequency relay in service

the load had been dropped. Curves of the gate opening plotted against time will be found in Figs. 2 to 16 inclusive. From these curves it is easy to explain why in some of the tests the speed of the generator reached a maximum and then remained constant, whereas in other tests (Figs. 10, 11 and 12) the speed reached a maximum, then began to decrease. In these three tests the gates were closed more rapidly than in the other, consequently the overspeed of the turbine diminished. In Fig. 11 a condition is shown in which the governor was operated partly by hand, which accounts for its rapid closing. The tests showed that the oil pressure in the governor has a marked effect on the speed of operation.

TABLE V—OPERATION OF OVERVOLTAGE OVERFREQUENCY RELAY

	Low-Tension Breaker Tripped		High-Tension Breaker Tripped	
	Fig. 13	Fig. 14	Fig. 15	Fig. 16
Load dropped, kw	17,460	17,220	17,460	17,300
Power factor, per cent	100	76.5*	100	75.5*
Increase in low-tension voltage, per cent	167	171	155	144
Increase in high-tension voltage, per cent	.....	.....	135	144
Operation of relay, per cent overspeed	117	108	120	112
Operation of relay, per cent overvoltage	161	165	135	143
Time for relay to operate, cycles	79.5	47	111.5	88

*Lag.

The results of the previous tests show that very high voltages will be encountered when a machine suddenly loses its load. An overvoltage overfrequency relay was installed and connected in such a way that it would open the generator field switch and main generator breaker when the speed had increased 8 per cent and the voltage 25 per cent of the normal value, the relay operating at 108 r.p.m. and 8,250 volts.

Effect of the Overvoltage Overfrequency Relay Operation.—The operation of this relay is shown in Figs. 13 to 16 inclusive. From these test curves it is apparent that the relay did not function with sufficient speed to prevent the voltage from reaching high values. This time lag may be due to incorrect setting of the relay or to sluggishness in the relay mechanism, or both, as mentioned in the first part of this article. Since tests were made with only one setting of the relay, there are not sufficient data available to locate the trouble definitely. The voltage drops very quickly, however, as soon as the relay operates and there is only a lag of three cycles between relay closing and switch opening.

Time of Relay Operation.—In the above tests it was impossible to determine the sequence of operation of the overvoltage and overfrequency elements of the relay; therefore in order to get definite information on the time required for each element to operate and the actual percentage increase above normal value at which they operate, tests were made in which only one element at a time was used. The results are shown in Figs. 17 and 18, with the maximum values given in Table VI. It would seem from these tests that the overvoltage element is responsible for the delayed action of the relay.

Decay of Generator Voltage When the Main Field Is Opened and When the Exciter Field Is Opened.—The decay of generator voltage, plotted against time, when the main generator field is opened and when the exciter field is opened is shown in Fig. 19. In both cases the generator was running with no load and an initial terminal voltage of 6,600 volts.

Time Constant of the Exciter Field.—The building up and decay of the current in the exciter field are shown in Figs. 19 and 20, and from these curves the time constant was calculated. It takes about six seconds for the current to build up from zero to its final value, but when the circuit is opened, the current decreases much more quickly, because of the discharge resistance that is connected across the field when the switch opens. Since the current in the field is changing during the process of building up and dying down, the inductance of the windings will also change. A curve was plotted (Fig. 19) to show the relation of the ratio L/R to time as the current builds up in the field. If the resistance (R) of the field is assumed to remain constant, the curve shows how the inductance (L) changes with time.

Building Up and Decay of Current in the Generator Field.—With the generator stationary, a voltage was impressed on its field by closing the field switch and an oscillogram of the building up of the current was taken. Likewise the switch was opened and an oscillogram was made of the decay of the current. The curves shown in Figs. 19 and 20 were plotted from these oscillograms. It will be noticed that when the field switch is closed the current suddenly increased to about 40 per cent of its final value and then fell off slightly before building up along an exponential curve as it should. Similarly, upon opening the field switch the current suddenly increased and then decreased very rapidly. This is caused by the discharge resistance of the generator field being momentarily connected in parallel with the field during part of the travel of the field switch; thus the discharge resistance is connected directly across the exciter terminals for a short interval of time.

Effect of Shorting the Resistance in Series with the Exciter Field.—The generator was running at normal speed with the field switch open. The exciter voltage was then brought up to 100 volts and the resistance in series with the exciter field short circuited. The result is depicted in Fig. 21 and shows that the exciter voltage will increase from 100 volts to 150 volts in a time interval of 70 cycles, or 1.166 seconds. The same test was made on the 1,200-r.p.m. motor-driven spare exciter and the results are also shown in Fig. 21. In this case the voltage on the spare exciter increased from 100 volts to 150 volts in 35 cycles, or 0.583 second.

TABLE VI—OPERATION OF RELAY BY ONE ELEMENT ONLY

	Low-Tension Breaker Tripped	
	Overfrequency Element, Fig. 17	Overvoltage Element, Fig. 18
Load dropped, kw	17,500	17,350
Power factor, per cent	100	99.9*
Increase in low-tension voltage, per cent	145	166
Overspeed operated, per cent	115	.....
Overvoltage operated, per cent	.....	160
Time for relay to operate, cycles	67	85.5

*Lag.

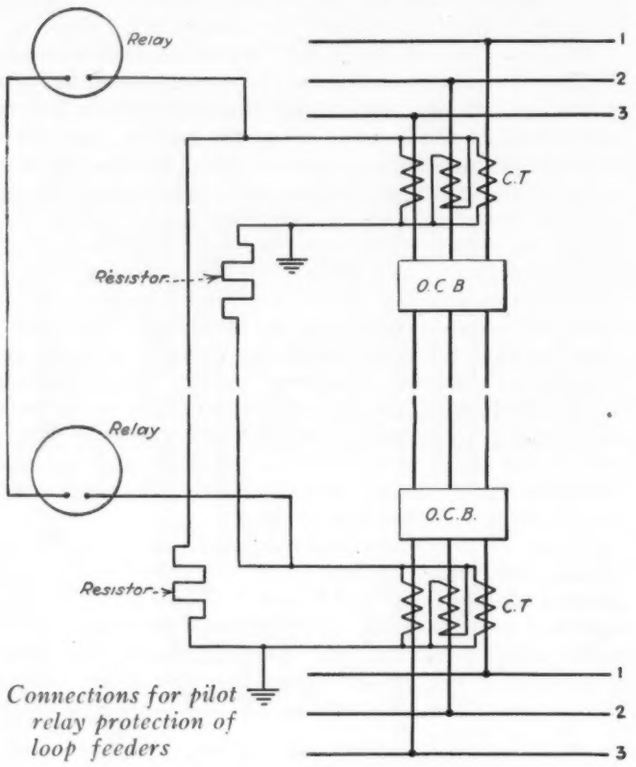
Decay of Exciter Voltage When Exciter Field is Opened.—In this test the generator was running at normal speed with the main field switch opened. The exciter voltage was adjusted to 250 volts, then the exciter field was opened. The time required for the exciter voltage to drop from 250 volts to 50 volts was approximately two seconds, the measurement being made with a voltmeter and stop watch.

Effect of Main Field Series Resistance.—With the exciter voltage held at 253 volts, all of the series resistance of the main field was cut in. The actual voltage across the generator field was thereby reduced to 75 volts, the current in the field was 220 amp. and the low-tension generator voltage was 5,700 volts.

Pilot-Wire Relay Scheme

By Earl Baughn
Engineering Department, Washington Water Power Company, Spokane, Wash.

VERY often it is desirable to protect short sections of primary loop feeders by some sort of pilot wire relay scheme. A scheme suggested by W. H. Cole is described on page 661 of the Oct. 1, 1927, issue of Electrical World. A modification of this scheme has been developed for the loop feeders supplying an alternating-current network in Spokane. The connections used are shown in the accompanying diagram.



Connections for pilot relay protection of loop feeders

Under normal conditions there is a current flowing in the pilot wire loop equal to twice the current in any one current transformer secondary. There is no current in the relay operating circuit, since the two ends of this circuit are connected to points of equal potential. In case of a cable fault between the two groups of current transformers the current from one group is reversed so that it opposes that of the other. There are then two paths for the current, one through the relay operating circuit and the other from the ground on one current transformer group to the ground on the other. The total current divides inversely as the impedance of the two pilot wires in series to the impedance of the relay circuit including the relays.

This scheme has the advantage of eliminating the one to one ratio current transformer used by Mr. Cole, and also, by the reversal of the secondaries of one current transformer in each group, protection is secured against three-phase and single-phase short circuits, except between lines 1 and 3, in addition to line to ground faults. Three-conductor cables of the usual types as well as cable of the Hockstadter type may be used when protected with such a relay scheme. Relays should be of as small volt-ampere load as possible. In cases where the pilot wire conductors are very short it may be necessary to include small resistors of one-half to one ohm resistance to increase the impedance of the pilot wire conductors so that a larger proportion of the current will flow through the relays rather than through the ground connections upon trouble within the section of cable protected.

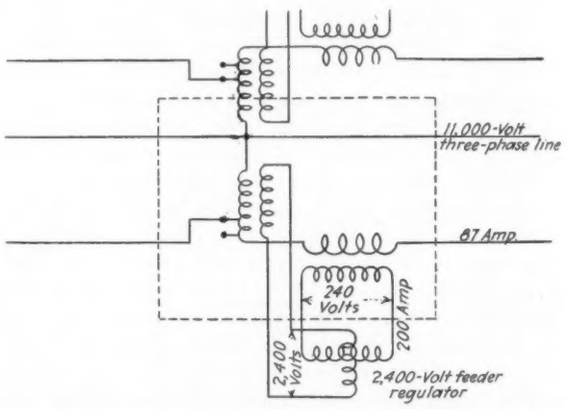
2,400-Volt Regulators Used for 11-Kv. Line

By E. F. Pearson
Electrical Engineer Northwestern Electric Company, Portland, Ore.

ADVANTAGES of using standard stock 2,400-volt feeder regulator equipment and a saving in cost over an 11,000-volt regulator led the Northwestern Electric Company to develop an ingenious scheme for regulating the voltage on an 11-kv. feeder. Two 200-amp. induction feeder regulators in conjunction with two special transformers, connected as shown in the accompanying diagram, give 10 per cent voltage regulation on an 11-kv., three-phase line.

Special four-winding transformers were built for the purpose by the Westinghouse Electric & Manufacturing Company. Two independent transformers contained in one case were placed on the same core. One is a series transformer with its primary excited from the 2,400-volt regulator and its secondary in series with the 11-kv. line. The other is a transformer with a tapped 11,000-volt primary winding to give a fixed boost by auto-transformer action and a 2,400-volt secondary winding to excite the regulators.

In the first installation made the regulator-exciting transformer was connected to give a fixed boost of 5 per cent. With this connection the regulator will buck the voltage 5 per cent to offset the 5 per cent fixed boost at light loads, so that the 11-kv. feeder voltage will be that normally impressed at the distant substation. At times of heavy load the boost of the regulator is added to the fixed boost, giving a total boost of 10 per cent. Any other combination of boost and buck may be had by selecting other taps on the auto-transformer winding.



Four-winding transformer and 2,400-volt regulator used on 11,000-volt line

A study of the problem when the scheme was first considered indicates that two single-phase regulating units, as described, would be preferable to a special three-phase transformer and a three-phase, 2,400-volt regulator. In considering this manner of regulation it was at first thought that there might be trouble with harmonic voltages, but this did not prove to be the case.

Financial Set-up Simplified

Subsidiaries of Buffalo, Niagara & Eastern system lose their identity in merger with the parent company

Based on an Interview with

F. D. COREY
President Buffalo, Niagara & Eastern Power Corporation

F. D. Corey

CONSOLIDATION or merger programs have been adopted by a number of the leading public utilities in recent months for materially simplifying their financial structures. Not infrequently existing franchises or the presence of uncallable securities have prevented a complete consummation of such programs. In the case of one representative company, the Buffalo, Niagara & Eastern Power Corporation, and its subsidiary corporations, engaged in the electrical business in the State of New York, the simplification process is complete and far reaching. The plan contemplates the consolidation into a single operating company of the Buffalo, Niagara & Eastern Power Corporation and its subsidiary corporations engaged in the electrical business in the State of New York, President F. D. Corey told a representative of the ELECTRICAL WORLD.

This unification into a single company presents less difficulties than many of the other power systems. The parent company as at present constituted is the holding company and owns practically all of the common stock of the subsidiaries. Furthermore, the preferred issues of the subsidiaries have been called and no restrictions or limitations appear to stand in the way of a complete consolidation of all of the above-mentioned companies. It is urged, and may be reasonably expected, that this unification or consolidation into a single operating company will reduce overhead very materially and result in a more economical and efficient operation of the properties. It is hoped that the unification process will be consummated at or near the end of the present calendar year.

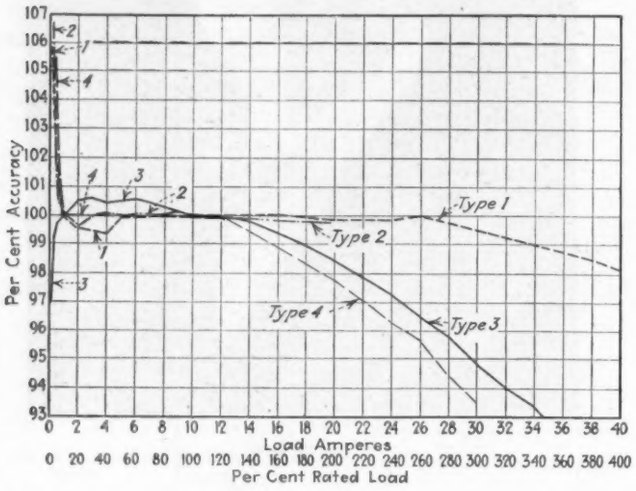
The first step taken in the proposed unification and reorganization plan was the authorization of an issue of 500,000 shares of first preferred stock without par value of the Buffalo, Niagara & Eastern Power Corporation. This step was consummated on April 2, 1928. Three hundred and fifty thousand shares of this issue will be used for the purpose of acquiring by exchange, or providing funds for the redemption of, the existing preferred stocks of the subsidiary companies. Such issues include 680,724 shares of preferred stock of the Niagara Falls Power Company, 497,785 shares of Niagara, Lockport & Ontario Power Company preferred stock and 4,568 shares of preferred A and 1,207 shares of preferred B stock of the Tonawanda Power Company. When the plan is completed the single company will be obligated for the entire funded indebtednesses of the group consolidated.

The reduction in overhead cost and the advantages accruing from centralized management need no special emphasis. It is obvious that a very substantial annual reduction in operating costs will be made. The actual saving in dividend charges will also be substantial. In the case of the Niagara Falls Power Company the present preferred issue is a 7 per cent one; the present Niagara, Lockport & Ontario Power company preferred issue is 6.4 per cent, and of the Tonawanda Power Company issues one is 7 per cent and the other is 6 per cent. Since the new issue is at the rate of $5 per share per annum, it is apparent that the actual money saving will be quite substantial.

In so far as the shares, or proceeds of shares, of first preferred stock are used for the acquisition or redemption of these subsidiary preferred stocks, their issue will somewhat increase the liquidation value of the securities which are senior to existing classes of stock of the corporation. At the same time it will materially increase the earnings available for dividends on such existing classes of stock and thus improve their position. The offer of an exchange of shares of the first preferred stock for outstanding shares of the subsidiary preferred stocks that has been made to the holders thereof enables them to receive an amount equal to the retirement or redemption price in shares of the new first preferred stock at the price of $95 per share. The portion of the 350,000 shares of first preferred stock not taken by exchange will be sold to provide funds to enable the subsidiary companies to retire or redeem their said preferred stocks at the retirement or redemption price thereof. Such retirement or redemption should be completed by June 30, 1928. From the foregoing it will appear that already substantial progress has been made in the carrying out of the program of unification and consolidation.

Watt-Hour Meter Performance Improved with Low-Speed Elements

AS A result of impartial tests with four types of watt-hour meters the load characteristic curves for sixteen instruments are represented in the accompanying figure. This information was presented by W. B. Brown, New Orleans Public Service, Inc., at the eighth annual convention of the Southwestern Geographic Division of the National Electric Light Association. Type 1 represents a low-speed, high-torque meter. Type 2 is a



Comparative performance of single-phase, two-wire, watt-hour meters

high-torque meter but a high-speed characteristic impairs its accuracy. Type 3 is a high-speed device rotating 100 per cent faster than type 1. Type 4 has a speed midway between that of 2 and 3. The most interesting feature of type 1 is that from approximately 4½ per cent rated load to 400 per cent rated load the meter registers within a limit of 2 per cent of perfect accuracy. This indicates a better development of the low-speed, high-torque principle which approaches the ideal condition of the 100 per cent performance curve

Remodeled Home Lighting Equal to Several Average Homes

By M. Luckiesh
Director Lighting Research Laboratory, National Lamp Works, Nela Park, Cleveland

THE old houses needing remodeling have received little attention during relighting and rewiring campaigns. Perhaps it has not been generally appreciated that several million such houses exist.

Recognizing the possibilities in increasing the resale value and in increasing the comfort and convenience in these old houses by a moderate expenditure, *Household Magazine* sponsored the remodeling of a typical old house in Dixon, Ill., and we specified the wiring and lighting equipment.

This house was wired and equipped for a few hundred dollars. It was originally an eight-room house and typical of several millions of old houses in this country. No shade worthy of the term was found in it. The old and new equipment are listed in the following table:

	Before Remodeling	After Remodeling
Convenience outlets	0	24
Wall brackets	0	7
Portable lamps	..	14
Ceiling fixtures	2	14
Drop cords	7	0
Tungsten lamps	11	69
Connected load (watts)	350	3,670
Wiring outlets	8	69

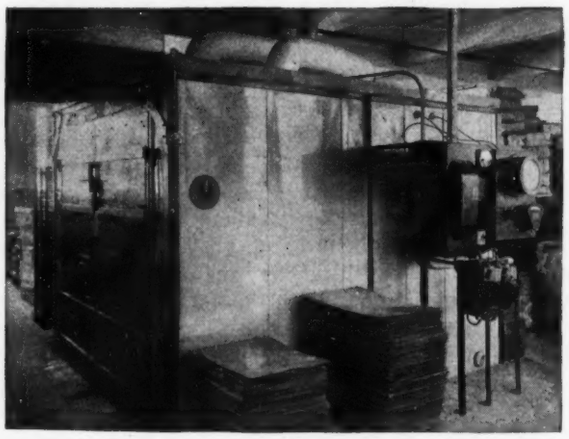
The remodeling of one such "old house" is the equivalent of adding several average homes (6½ rooms) to the central-station lines, as indicated below:

	Remodeled Home	Average Home
Convenience outlets	24	4
Portable lamps	14	3
Utility brackets	7	4
Ceiling fixtures	14	9
Tungsten lamps	69	27
Connected load (watts)	3,670	1,000

This is just the beginning of an activity which will prove profitable to all concerned. It will mean, to the householder, a home in exchange for a house and a few hundred dollars. It will mean increased lamp, fixture, wiring and energy sales to those concerned.

Varnished Metal Baked at 2.4 Cents per 100 Lb.

"OUR total cost for electric baking, 2.4 cents per 100 lb. of metal, is so low that we would not consider using gas or oil ovens with their increased fire hazard," states W. C. Kenney, president of the Kenney Manufacturing Company, Auburn, R. I., in connection with operating results obtained from an electric oven installation designed by C. I. Hayes, Providence, R. I. The above cost includes overhead. Two 30-kw. ovens



Uniform results and low costs led to purchase of duplicate oven

are in service in this plant, which uses them in baking lacquer on tin plate employed in making curtain rods. The operating schedule calls for a one-hour bake at 250 deg. F. The ovens are operated single phase, but can be run on three-phase circuits if desired. The Kenney company further states that it finds no variation in the color of the work turned out, which means that every bake is the same and the temperature uniform throughout the oven.

The Parable of the Range in the Parlor

A true story that has led to the standardization of heavier home services in many cities

By Earl Whitehorne

ONCE upon a time a certain salesman called upon the general manager of a certain power company. He knew him well and when he came in the G. M. shut the door and began to tear his hair and curse the gas company. It was a sad, sad story he had to tell.

It seems that this general manager six months ago, in a sparkling moment, had one day in a much-advertised contest given away to a fortunate customer one electric range. It was a beautiful big range, replete with hot and cold folding doors, gold fingernails and all the latest improvements. It was delivered to the modest home of one John Doe and deposited in the parlor—for there was no room in the kitchen.

Now John Doe was delighted and so was Jenny and so were little Jack and the baby to have possession of this lovely thing. And John immediately sent for an electrical contractor to see about getting this fine and noble cook stove to work. The contractor found, of course, that the wiring in the little home of the Does would not carry a range and figured out an estimate on running a new service, a range circuit, installing the necessary switches, and so forth. The cost would be $65, he told John.

And then John said, "Why, what is all this $65 for?"

The contractor explained that John's service was inadequate. He had ¾-in. conduit, two No. 10 wires and a 30-amp. meter service switch. The first thing the contractor would have to do would be to tear out this old service and in its place install 1¼-in. conduit, three No. 6 wires and a 60-amp. meter service switch, and then run wires from the service up to the kitchen. The big cost of the installation would be the meter service.

"Well," John said, "I can't understand why big enough service wasn't put in at the time the house was built."

The contractor said, "Well, you're right. If it had been done then it would only have cost you around $15 instead of $65 to connect this range up now."

The range continued to encumber the parlor. This is a true story and the facts must be faced.

Now there came one evening to the home of the Does two friends to call. And the man friend said to John, "What's that there in the corner?"

"It's an electric range," said John, and he told them the wonderful story of how they won this hifalutin' and expensive luxury in a contest.

"Well, what's it for?" asked the friend.

"Why, to cook with," answered John.

"Well, what's it doing in here?" exclaimed the friend. "Why don't you put it in the kitchen and use it?" And then Jenny Doe explained, as wives will. They couldn't afford to rewire their house in order to connect it. Maybe they couldn't afford to use it. But they had it.

Well, to cut a long tale short, they all went out into the kitchen to look at the place where it might be put—as people do—and there was the old bedraggled gas range. And then the friend gave birth to an idea.

"Why don't you see if you can't exchange it for a new gas range?" said he. That was an exciting moment. So it was when the man came from the gas company. He also had an idea. Of course, they were not in the electric range business, but why did the Does want to fool with an electric stove that would ruin them if they ever tried to cook on it. Let's go right down and see some nice new gas ranges. Now here's this bee-utiful new gas cabinet range with extra double X enamel and nickel knuckles. It costs $150, but we will deliver it to your house and connect it up absolutely without charge and cart away your old black gas range and remove your despicable $350 electric range right out of the parlor. Who wants a range in the parlor anyhow? The idea! Thus the salesman.

And that is just what happened. And then next week in the big front window of the gas company was an interesting exhibit. A large gray electric range—in a gas window, mind you—and there was a great placard that read—"John Doe won this electric range in a contest. It cost him nothing. But he found that it would cost so much to have it wired up and then to use it that he came down here and bought a No. 17 Young Bride's Delight and asked us to take this off his hands"—or words to that effect.

And the general manager of the power company threatened and swore. And his friend the salesman said, "Wait a minute, I know the gas man. Let me go and see if I can't straighten it out. And he went and he did.

Service Inadequacy

And then this salesman got to thinking and he went back to his friend the general manager of the power company and told him that the fatal electric range was no more in the gas office window. And he asked him a question. "Why is it," he said, "that this kind of thing can happen, that a man can win a beautiful electric range and take it home delighted with it and then not be able to use it and finally throw it out and pay his fuel money to the gas company? What's wrong with us in the electrical industry?" And then he told him.

"Did it ever occur to you," he asked the G.M., "that through the 40 years we electrical men have been connecting houses to the power systems of America—until we've got some seventeen million and a half—that in practically every house we have deliberately blocked our future market? Consider these four things:

1. When the gas company takes on a customer it installs a service and a meter. In the beginning there may be just a small range in the kitchen. But later if the customer decides to have a gas water heater or a gas radiator he simply installs it and connects it. The meter and the service are adequate.

2. When the water company runs a service to a house and sets a meter there may be only one bathroom and a kitchen sink. But

later if the family wants two more baths and a downstairs toilet there is no trouble about it. The service and the meter are ready. There is no need to go to the city for a permit and to pay for a bigger main and a more costly service. You use the water that you want.

3. And just so, when you have a telephone put in, your idea is that you desire to talk to other people in your town or in a nearby town or city. But suppose you wish to call Chicago, or New York, or San Francisco, or even London, are you compelled to ask the company for a different instrument, a bigger service and a special preparation for this broader, unexpected use of your telephone? You are not. You take the receiver down and just say, "Give me Chicago 41144," and you get it.

4. But when you apply for our electric service, your home is wired and you make application to the power company. The contractor installs a 30-amp. service entrance switch. The utility sets a 15-amp. meter, perhaps. Everything is lovely—until some day you and your wife decide to cook electrically. And then you find that though you can have plenty of gas for a water heater, or plenty of water for another bathroom or can talk to Florida through the same telephone you had put in to chatter round the town, when it comes to electricity all is very different. For the great electrical industry is not accustomed to have people ask suddenly to use more service than they expected. In fact, the great electrical industry hasn't been organized with any such idea in mind.

"And so in all America any large additional use of electric service is barred because the service arrangements and the meter, having no imagination of their own, have not expected it and are not ready. And if John Doe or Mrs. Mary Brady want to use an electric range they must call for a contractor and rewire their house, and put in heavier copper up to the range. For the electrical industry gives warning that it permits no man or woman to change his or her mind and cook by electricity unless he or she pays perhaps $40, or in some towns $90 or more, to change the wiring. It has never occurred to electrical men that the service entrance might be made ready in advance."

Better Standard

That's what the salesman said. And the general manager thought a while and he said, "I guess you're right. I'd never thought of it before."

And then the salesman said, "Why don't we put an end to this condition in this town by standardizing at least on a 60-amp. service entrance so when somebody wants to use a range, at least the service will be ready, and there will only be a very small expense to run a circuit to the kitchen?"

And the general manager agreed and they called a meeting of all the local contractors and the inspectors and everybody interested and before long there was established in that city a new ruling that has standardized the 60-amp. service capacity—ready to serve.

And filled with zeal from this experience, this salesman has been preaching this gospel in other cities and getting other groups together, and out of this work has come a movement. The idea has been planted in many minds and it looks as though in many cities they are going to tear down this old barrier to the increased use of electricity by standardizing on a minimum service capacity of three No. 6 wires and a 60-amp. service switch on all services in their jurisdiction. At the present time in Grand Rapids and Lansing, Mich., they now have rulings of this nature in effect. A letter which I received recently from a Grand Rapids electrical man said: "I want to add that our 60-amp. rule is working out fine and every one is satisfied."

But it has not been easy. In some sections there is the most determined opposition on the part of the power companies. It has never been done. It is not necessary. People are not using ranges. It will make house wiring more expensive. These and a dozen other reasons are thrown up. But none of them can stand against the cold logic that bids the electrical industry remove these barriers that now prevent the greater use of electricity for cooking and for water heating.

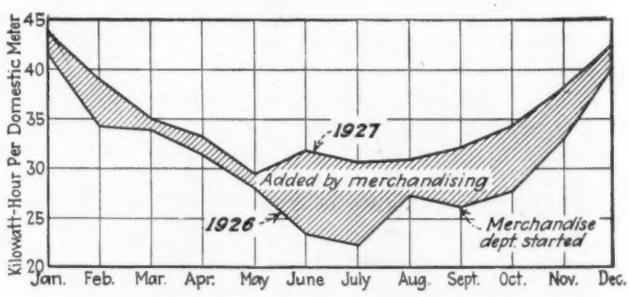
It is about time that we exposed ourselves to the possibility that some day the Johns and Marys in these houses will desire and have the right to cook and heat their water electrically. Forethought and preparation are highly regarded in most instances. Must the electrical industry deny itself the opportunity to profit by this good old axiom in so many homes? Is our vaunted readiness to serve to be so easily confounded?

No. It is high time for us in the electrical industry to join this adequate service movement and begin automatically to provide our customers with an adequate service when a home is built or a building is wired. Then there won't be any more ranges reposing in the parlors.

Revenue per Meter Increased by Merchandising

THAT the kilowatt-hour consumption and revenue per domestic customer is increased directly as the result of efforts on merchandising is shown in the experience of the Southwestern Gas & Electric Company, of which Edwin W. Vennard is general commercial manager. This company is a firm believer in concentrated merchandising activities because it has followed closely its effect upon the residential use of energy in the towns served and can see the concrete benefits in increased domestic revenue.

The accompanying chart shows the increase in the domestic kilowatt-hour consumption for 1927 over 1926 in Shreveport, La., which is the largest community served by the company. In 1926 the average consumption per meter per month varied from 42 kw.-hr. in January down to approximately 22 kw.-hr. in the summer time. In



Effect of merchandising upon kilowatt-hour consumption per domestic meter

The energy consumption in July, 1927, increased 7½ kw.-hr. per meter over July, 1926. Based on 7½ cents per kilowatt-hour, the total revenue increase for 12,000 meters was $6,800.

September, 1926, a merchandise department was installed in Shreveport and aggressive appliance selling was commenced. Results have been most gratifying, as shown by the increase of 7½ kw.-hr. per domestic meter in 1927 over 1926. The two curves indicate this very clearly, particularly the increases during the summer months following a very active campaign on electric fans. Based on an average rate of 7½ cents per kilowatt-hour the revenue increase from 12,000 meters in July, 1927, was approximately $6,800.

Variable speed motors increase paper cutter output 33⅓ per cent

Paper-Mill Motorization

Improves Production and Quality

Keen competition has made it necessary to devise new ways of automatically controlling product and cost of making it

By R. S. LOWRY

Formerly Electrical Engineer Champion Coated Paper Company, Now Chief Engineer Ingalls Stone Company, Bedford, Ind.

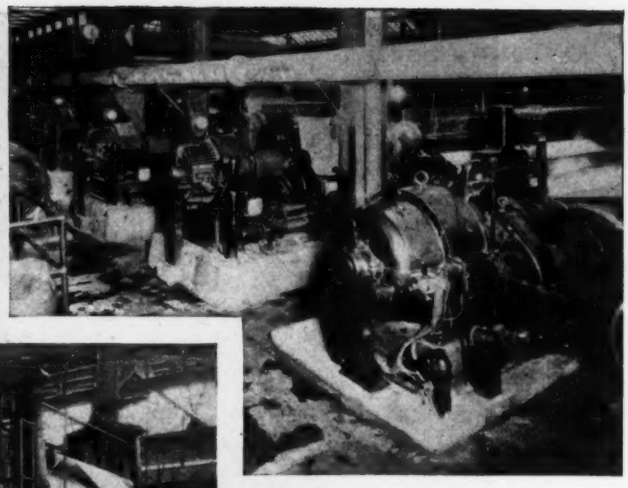
MANY changes have been made in paper-mill machines and in the method of driving and controlling them which tend to take much of the human element out of paper making. It is this human factor which interferes to a large degree with the production of a uniform quality and which also tends to make for varying costs in the production of the same grade of paper over long periods of time. Although some human supervision will always be needed, "feel" and sight enter so much into the making of paper, even at the present time, that uniformity of quality is hard to guarantee without considerable "waste" and time loss after repeated trials to meet certain specifications. The use of various meters is helping to eliminate what might be termed guesswork. They determine the quality of the stock and the ingredients which go into the product, giving the same results regardless of who is observing readings.

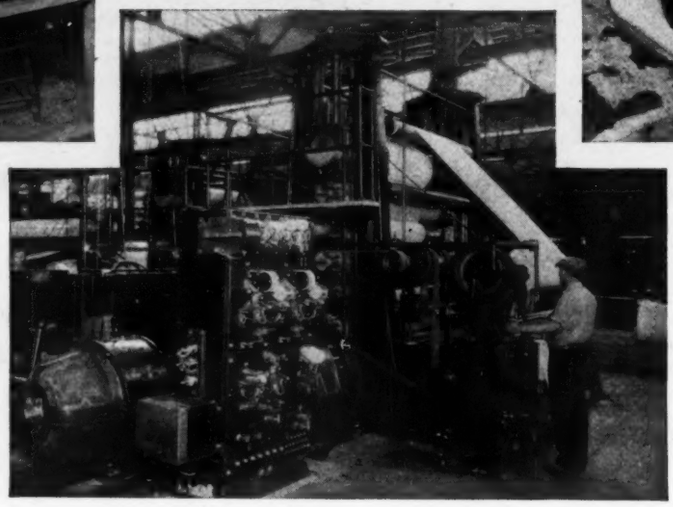
Proper motorization of individual machines not only tends to save power but places machines so perfectly under the control of the operator that he is able to obtain results not possible with other methods of driving.

Stock pumps driven by motors may actually affect in an indirect way the quality of the stock handled, for it is possible to vary the speed of the motor to suit the amount of stock to be delivered to the machine and thus reduce the amount returned to chests or agitators. The circulating of an unnecessary amount of stock besides wasting power has a deleterious effect on the stock. In many cases the pump may actually be shut down at times with resultant savings and benefit to stock. By placing an ammeter on the pump motor it is possible to tell the condition of the pump and the piping system and thus foresee trouble which might later interfere seriously with production.

Motorization of the beater engines has taken a great amount of the human element out of paper making. A motor on each beater makes for greater flexibility, saves power and might almost be considered an absolute necessity if it is desired to know exactly what goes on in the beater. A meter will tell very closely how "hard the roll is on the plate." The exact pressure cannot be told by sound. The accompanying chart serves to illustrate how far wrong a beaterman may be in attempting to set the roll by sound.

A beater roll which rests on the bedplate too firmly will not give as good results, so far as treatment of the stock is concerned, as one which rubs the plate firmly but allows the bearings to take part of the weight of the roll. Motorization tends to check overfurnishing of the beater or too great a change in stock consistency. Overfurnishing of the beater prevents proper circula-





Top, left — Direct-current motors on platers double output

Top, right — Sectional drive of book paper machines

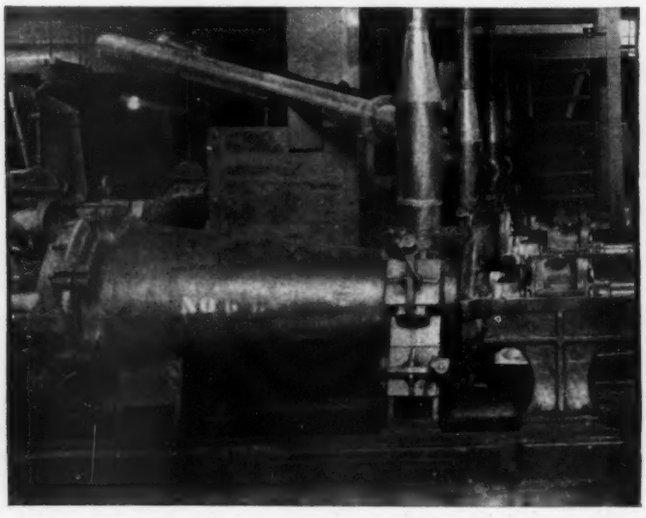
At left—Super-calender driven by single direct-current motor allows high speeds

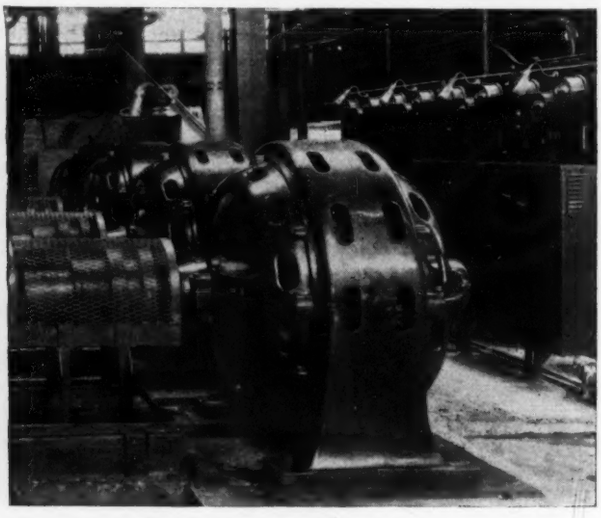
tion of stock with consequent heating and non-uniformity of treatment.

Probably no machine in the paper mill has a greater influence on the power bill than the beater. It can be considered as an enormous brake in the hands of men not greatly interested in saving power. Even motors 100 per cent larger than necessary for proper beating can easily be stalled by a careless beaterman unless the control is equipped with proper protective apparatus. Here is where the motor with its meters proves valuable.

The Jordan engine has lent itself admirably to motorization and here the quality of stock is also affected by the method of drive. This is an ideal application for the synchronous motor, which holds the Jordan absolutely to one speed for all loads and insures uniform treatment of the fibers for any setting of the plug. A wattmeter indicates the pressure of plug against shell and much more accurately than depending on sound. A badly worn plug or shell will cause the power to mount high and the relays may even operate to remove the motor from the line. When this condition of plug and shell exists the stock will probably not be "short" enough and the meter indications are proof positive of what the trouble is.

Sectional drive of paper machines is now out of the experimental stage and here the electric motor performs admirably to improve the quantity and quality of the output. The advantages of the sectional drive are numerous and in some respects revolutionary. Due to smooth starting and running and to the fact that at all times the amount of pull on the "wire" of the Fourdrinier is accurately known from meter indications the life of the wire will often be doubled or trebled. Should the stock in the wire be too "slow" or contain too much water, necessitating too high a vacuum or too many "flat boxes," the meter on the motor will indicate an abnormal



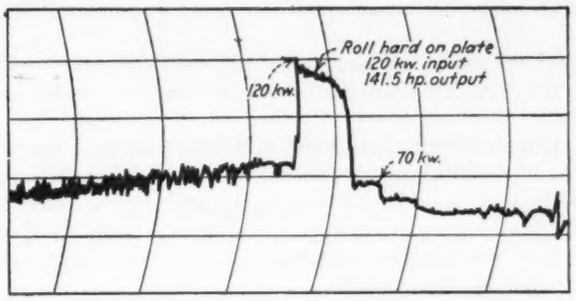


Battery of four Jordans driven by synchronous motors

load. Conversely, the above condition would be indicated by an abnormal load on the motor. The "draw" between the various sections can be accurately adjusted and also can be calculated from meter readings. At the dry end of the machine the paper has its maximum strength in tension. It is frequently a question of dispute between machine tenders whether the draw is right between the last drier and first calender sections. It seems that no two men judge alike, but a glance at the meters on a sectional drive will settle the dispute.

The writer recollects a case where the paper was snapping off at the first calender. By quickly taking meter readings and calculating the horsepower being transmitted by the sheet and getting it down to pounds pull it was found the paper was actually under a tension of 130 lb. per foot of width, which was nearly double the required breaking strength for the grade.

Separate motors on each section of a paper machine also segregate bearing and other troubles causing abnormal loads. As an illustration one machine normally required 70 amp. on the first drier section. One day the load increased to 75 amp. and on the following day,



Guesswork expensive in beater operation

After power readings had been taken of the beater and the roll setting pronounced right to give the desired results the roll was raised and the beaterman asked to again set the roll at the same point. With the correct setting the motor was taking only about 70 kw., while after resetting the roll the motor pulled 120 kw., or an overload of 71 per cent.

which happened to be Saturday, the ampere load had increased to 80. Converted into horsepower this increase in amperage was equivalent to only about 2 hp. On Sunday morning, with the machine down, each bearing on the first drier section was carefully examined. On the back side of the machine on one of the drier rolls, where it was impossible to get at the bearing with the machine running, a bearing was found entirely lacking oil. The bearing and journal had not been cut as the meters, having shown up trouble with such a small increase in power, had made it possible to locate the trouble before any damage was done. With other types of drive the trouble would hardly have been located until the bearing smoked, which might possibly have meant a shutdown and attendant loss of production.

Super-calenders driven from line shafts are far out of date and unsatisfactory. Often the breaking of the sheet on one calender will cause the paper to snap off on one or more of the other calenders operated from the same line shaft. Speeds as high as 1,000 ft. per minute are now attained by proper motorization. Needless to say, the calender must be under perfect control at this speed or should the paper break there would be a great amount of waste and the cotton or fiber rolls of the stack might be damaged.

With a calender drive lately developed it is possible to stop the stacks within 10 ft. of paper or before a "tag end" can enter the stack, and this from a speed of 1,000 ft. per minute. This higher speed means an increase in output of 60 per cent to 75 per cent over line-shaft drive or even some of the old types of motor drive. The adjustable speed motor allowing a range in speed from 30 ft. per minute to 1,000 or more feet per minute permits the operator to run the calender at the speed best suiting the grade of paper. Furthermore, waste, due to breaks, can be practically eliminated.

Plater Electrification Speeds Production

Probably the most startling effect of motorization on production occurs in electrifying a plater. This machine consists of two chilled rolls which are caused to run alternately forward and backward by the driving mechanism. In the case of a motor-driven machine the motor is simply reversed after being "plugged." Before passing through the plater rolls the sheets of paper or cardboard are placed between alternate sheets of zinc in stacks ranging from about 1 in. to several inches in height. This stack is then passed back and forth between the rolls under enormous pressure, the zinc sheets imparting a special finish to the cardboard.

With the original line-shaft drive the operator was able to keep only one crew of three girls busy stacking and unstacking the sheets. The motor drive and its control speeded up the machine to such an extent that another crew of girls was placed at the operator's right. The output was doubled, or, in other words, one machine did the work of two.

Paper cutters run by adjustable-speed motors with push-button control will immediately show an increase of output of from 25 per cent to 33⅓ per cent, depending on the operator. Where a number of cutters side by side have been properly motorized the factor of rivalry between workmen enters in so strongly that the increase in output is often amazing. Each operator is interested in seeing his or her pile of paper grow faster than his neighbors' and new interest is taken in the work. Certainly there is no better way in the world of getting an increase in output. The process is automatic.

This is the age of speed and, given the correct equipment, the workman carries the tendency right to his work and enjoys it to the mutual benefit of himself and his employer. With correct equipment the workman produces more with the same or less energy expended and it has not cost him anything. He is better off and so is the industry.

A Freak Cause of Service Outage

THE list of freak causes of trouble on electric systems continues to grow. The switch on a 4,800-volt power line of a large Middle West company opened automatically at 4:32 one morning recently and service on the line was interrupted for three minutes. Two phases were found burned open and the third conductor badly damaged at the trainer leads to a transformer bank serving an industrial customer. Temporary repairs restored service to this customer at 6:55 a.m. The trouble later was found to be due to a felt ball about 12 in. in diameter which had been used by workmen on a job in the vicinity for a game of basketball, probably during their noon hour, the loops to the transformer being used as a basket. The ball was left lying in the loops, presumably for several days, and, becoming rain-soaked, caused an arc-over between two leads, burning them open. The wire was No. 00, rubber covered.

Trend of Electrical and General Industry Compared

A COMPARISON of the viewpoint of executives of the electrical industry and executives of industry in general is shown in the accompanying tabulation. In a study to develop trends in general industry the Sherman Corporation, Boston, asked executives of all manufacturing concerns to check a list of factors as to whether they were, in the case of the reporting company, favorable or unfavorable. Another list showing the trend of practice in industry also was checked.

It is clear that the electrical industry considers competition, overproduction, profit margins, surplus plant capacity, selling and distribution expenses and hand-to-mouth buying as the outstanding unfavorable items. General industry, on the other hand, looks on none of these items as unfavorably as does the electrical industry. In the case of competition, only 9 per cent of general industry considers it unfavorable, compared to 91 per cent that looks upon it as favorable. On the other hand, 67 per cent of the electrical industry considers competition unfavorable and none considers it favorable, the remainder giving no definite answer.

In addition to the tabulated data some interesting statements from manufacturers in the electrical industry were received by the Sherman Corporation. These electrical industry executives reported their judgments as to what they believed are the problems of business in 1928. Some of the opinions are as follows: A manufacturer of lighting equipment says he considers as the major problems in his industry for 1928 intensive selling, cutting down overhead and less volume and greater profit.

A manufacturer of electrical products declares that distribution, research, employer-employee relationships are the principal problems in his industry.

A manufacturer of electrical welding rings, rims, bands, angles and flanges says that he finds his principal problems are further reduction in manufacturing costs and domestic and foreign competition.

FAVORABLE AND UNFAVORABLE FACTORS IN INDUSTRY

	General Industry		Electrical Industry	
Factor (General Conditions)	Per Cent Favorable	Per Cent Unfavorable	Per Cent Favorable	Per Cent Unfavorable
1. Money rates	98	2	67	00
2. Employee relationships	93	7	67	00
3. Labor efficiency	84	12	67	33
4. Credits	84	16	100	00
5. Wage scales	81	19	67	33
6. Collections	74	26	100	00
7. Development of new products	74	26	67	00
8. Commodity prices	69	31	33	33
9. Inventory turnover	67	33	33	33
10. Mergers	65	35	33	00
11. Style	62	38	00	00
12. Agricultural conditions	55	45	00	00
13. Political developments	54	46	00	00
14. Capital turnover	54	46	67	33
15. Weather	51	49	33	00
Factor (Special Conditions)				
1. Competition	91	9	00	67
2. Competition from within industry	87	13	33	33
3. Overproduction	87	13	00	67
4. Profit margins	77	23	00	100
5. Limited markets	77	23	00	00
6. Federal taxation	77	23	00	00
7. Competition from outside industry	76	24	00	00
8. State taxation	72	28	00	33
9. Surplus plant capacity	69	31	00	67
10. Foreign competition	67	33	00	00
11. Local taxation	65	35	33	33
12. Installment selling	63	37	33	00
13. Government regulation of business	62	38	00	00
14. Selling and distribution expenses	59	41	00	67
15. Hand-to-mouth buying	59	41	00	100

TREND OF PRACTICE IN INDUSTRY

	General Industry		Electrical Industry	
Have You	Per Cent Yes	Per Cent No	Per Cent Yes	Per Cent No
Reduced unit manufacturing costs	73	27	84	16
Reduced overhead	56	44	40	48
Reduced sales expense	29	71	42	58
Reduced selling price	54	46	58	33
Reduced number of items	27	73	33	56
Increased number of items	44	56	33	66
Purchased new machinery	70	30	75	17
Increased inventory turnover	60	40	58	33
Increased capital turnover	46	54	33	58
Cut down manufacturing time	52	48	75	25
Carried on product research	61	39	75	08
Carried on process research	61	39	67	25
Carried on market research	56	44	67	25
Developed new merchandising plans	52	48	92	08
Increased sales volume	52	48	25	67
Improved quality	82	18	83	17
Cut quality	1	99	00	92
Changed wage methods	13	87	00	92
Revised wage scales—upward	16	84	17	83
Revised wage scales—downward	17	83	08	92
Has advertising appropriation been increased	34	66	50	50
Has advertising appropriation been decreased	20	80	25	75
Have there been major changes in personnel	14	86	25	42
General management	16	84	17	25
Sales executives	23	77	42	17
Production executives	22	78	17	25
Have you had merger under serious consideration	20	80	00	75

NOTE—Where the "Yes" and "No" percentages, for any one factor, do not add up to 100, it is because some of the matters were not reported on.

A manufacturer of electric motors and generators says that his problems are sales, manufacturing costs and prices.

A manufacturer of electrical specialties reports that the matter of maintaining or increasing sales without driving sales costs out of line will be the big problem in 1928.

A manufacturer of electric appliances feels that the matter of maintaining volume at a better rate of profit will be his major problem.

A few of the statements made by manufacturers in the electrical industry, outlining the basic causes of the increase or decrease in profit margins, may be of interest and are as follows:

Reasons for Increased Profits: Electrical products—"Improved manufacturing methods."

Electrical specialties—"Price reductions and increased sales work."

Household appliances—"By manufacturing items formerly purchased, lower labor costs even at a higher average wage scale, and slightly increased sales volume."

Reasons for Decreased Profits: Electrical equipment—"Sales volume decreased about 10 per cent; sales price decreased about 10 per cent; we have not thought it wise to decrease our burdens to correspond with decreased volume and price; only reductives are such as naturally accrue from decreased production."

Creating Favorable First Impression

REALIZING that first impressions are often lasting and that many an electric range, electric refrigerator or other appliance is in disrepute with the customer because of some misunderstanding or lack of information concerning its use, H. H. Courtright, manager of the merchandising division of the San Joaquin Light & Power Corporation, has adopted a means of eliminating the possibility of unfavorable first impressions of electric refrigerator purchasers.

Before delivering a refrigerator it is thoroughly inspected and tested and delivered with the coils frosted, or at least very cold. No trays are delivered with the refrigerator. The installation man mentions this to the housewife and tells her that a salesman will come with the trays as soon as the machine is set up. Following the installer comes the salesman with the trays. The ice

tray is filled with ice cubes and the dessert tray with a frozen pudding ready to be served. An apology is made for not having sent the trays with the machine, but the salesman suggests that the housewife may be glad to have the ice cubes ready when her husband comes home. Also he mentions the fact that there is enough frozen dessert for two families and suggests that perhaps she would like to show her new machine to the neighbors and have them taste the frozen dessert.

This delights the housewife and she calls in the neighbors and treats them to some of the dessert and the refrigerator is "sold" from the time it enters the house. This plan was adopted because it was found that the trays often have an invisible film of oil on them from the stamping process and if they are not thoroughly cleaned the first batch of ice cubes will taste of oil and the refrigerator will prove a disappointment to the whole family. The first experience with frozen dessert may likewise prove unsatisfactory. The method adopted by Mr. Courtright eliminates these possibilities and gives him an opportunity to improve the company's relations with its customers and often develops prospects for other sales.

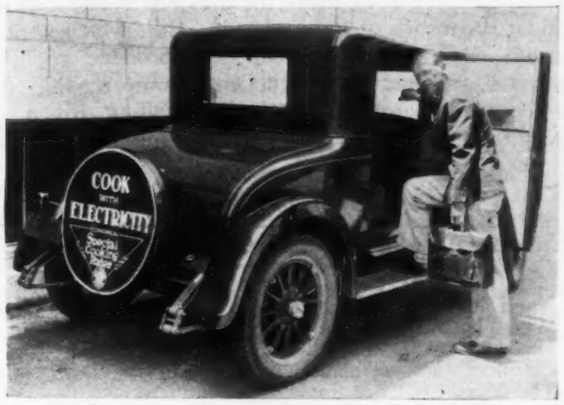
Appliance-Use Table Answers Cost Queries

By Willard Allphin
Fall River (Mass.) Electric Light Company

TO ENABLE residential service customers quickly to estimate the cost of using various leading appliances on the Fall River Electric Light Company's new household rate a table has been prepared showing how much each appliance adds to the previous monthly bill over a wide range of values. The residential service rate referred to is as follows: First 25 kw.-hr. per month, at 8 cents each; next 75 kw.-hr., 5 cents each; over 100 kw.-hr., 3 cents each; minimum charge, $6 per year. Thirty thousand folders, 8⅜ in. x 10¼ in. in size, have been printed carrying this table with an illustrative application.

Tire Cover Is Silent Salesman for Electric Cooking

ONCE a thing has become an established fact in the minds of customers there is rarely any question as to its value or practicability. The Valley Electrical Supply Company, merchandising subsidiary of the San Joaquin Light & Power Corporation, believes that by equipping 250 automobiles of the two companies with tire covers advertising electric cooking a state of consciousness will be created in the public mind that will bring about a better understanding of the salient facts regarding electric cooking.



Electric cooking message on 250 company automobiles

These 250 cars traversing the entire system with their tire covers are silent salesmen and act as constant reminders of the fact that there is a special rate for electric cooking; that it is clean, cool and economical. The tire covers are also a means of identifying salesmen and it has been found that the men are taking particular pains to park where the sign will be most conspicuous.

The copy on the cover is brief and the design and color scheme are planned to gain the most in readability.

Message from Fall River Electric Company to Its Customers

In using this table, use the new total each time you add an appliance. For example, suppose your average bill at present is $1.35 and you wish to know how much it would be if you added a refrigerator, a range and a washing machine. In the column headed $1.25 to $1.50, we find that the refrigerator will cost approximately $2.70 a month. Adding this to $1.35 gives us a new total of $4.05. In the column headed $4 to $4.50, we find that a range for three people will cost approximately $3.55. Adding this to the $4.05 gives us a total of $7.60. Since the new bill is over $5.75, the washing machine will cost approximately $0.03 a month to operate, or a grand total of $7.63 for all electric service.

We suggest that you save this folder for future reference, and if you have any further questions please feel free to call on us to telephone 1730—Power Department.

If your present monthly bill is from	$0.50 to 0.75	0.75 to 1.00	1.00 to 1.25	1.25 to 1.50	1.50 to 1.75	1.75 to 2.00	2.00 to 2.25	2.25 to 2.50	2.50 to 2.75	2.75 to 3.00	3.00 to 3.50	3.50 to 4.00	4.00 to 4.50	4.50 to 5.00	5.00 to 5.75	Over 5.75
The cost per month of operating an																
Electric range, one to three people will be about	5.30	5.15	5.00	4.85	4.70	4.55	4.45	4.30	4.20	4.10	3.95	3.75	3.55	3.35	3.10	3.00
Electric range, four to six people will be about	6.05	5.90	5.75	5.60	5.45	5.30	5.15	5.05	4.95	4.85	4.70	4.50	4.30	4.10	3.85	3.75
Refrigerator	3.00	2.90	2.80	2.70	2.60	2.53	2.50	2.50	2.50	2.50	2.45	2.25	2.05	1.85	1.60	1.50
Water heater, one to three people	5.00	4.85	4.70	4.55	4.40	4.25	4.10	4.00	3.90	3.80	3.65	3.45	3.25	3.05	2.80	2.70
Water heater, four to six people	6.80	6.65	6.50	6.35	6.20	6.05	5.90	5.80	5.70	5.60	5.45	5.25	5.05	4.85	4.60	4.50
Flat iron, one to three people	0.40	0.40	0.40	0.40	0.37	0.28	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.22	0.15
Flat iron, four to six people	0.72	0.72	0.72	0.66	0.57	0.48	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.37	0.27
Vacuum sweeper, five-room house	0.16	0.16	0.16	0.16	0.16	0.13	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.08	0.06
Vacuum sweeper, eight-room house	0.24	0.24	0.24	0.24	0.24	0.18	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.13	0.09
Toaster, ten minutes per day	0.16	0.16	0.16	0.16	0.16	0.13	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.08	0.06
Toaster, twenty minutes per day	0.32	0.32	0.32	0.32	0.32	0.26	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.16	0.12
Washing machine, one to three people	0.12	0.12	0.12	0.12	0.12	0.10	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.05
Washing machine, four to six people	0.24	0.24	0.24	0.24	0.24	0.18	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.13	0.09
Grill, ten minutes per day	0.16	0.16	0.16	0.16	0.16	0.13	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.08	0.06
Grill, 20 minutes per day	0.32	0.32	0.32	0.32	0.32	0.23	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.16	0.12
Percolator, fifteen minutes per day	0.16	0.16	0.16	0.16	0.16	0.13	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.08	0.06
Percolator, thirty minutes per day	0.32	0.32	0.32	0.32	0.32	0.26	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.16	0.12
Waffle iron, two hours per month	0.12	0.12	0.12	0.12	0.12	0.10	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.05
Waffle iron, four hours per month	0.24	0.24	0.24	0.24	0.24	0.18	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.13	0.09
Heating pad	0.08	0.08	0.08	0.08	0.08	0.08	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.03
Fan	0.16	0.16	0.16	0.16	0.16	0.13	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.08	0.06
Sewing machine	0.08	0.08	0.08	0.08	0.08	0.08	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.03
Portable heater, one hour per day	1.48	1.39	1.30	1.21	1.12	1.03	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.70	0.60
Portable heater, two hours per day	2.48	2.39	2.30	2.21	2.12	2.03	2.00	2.00	2.00	2.00	2.00	1.96	1.76	1.55	1.30	1.20

Bills as Messengers*

By H. T. East
Assistant to Vice-President
Public Service Company of Northern Illinois

THE electric service bill may be considered as merely a statement informing the consumer of the amount due the company for the preceding month or it may be looked upon as a periodic contact with each and every patron of the company. If the bill is regarded as a monthly customer contact, as it certainly should be, the natural tendency is to study the messenger and carefully consider the means of improving it. Bills which are neat, accurate, distinctive and clear help produce good will and offset, to some extent, the unwelcome feeling which the receipt of any communication calling for a cash expenditure naturally produces in the mind of the none-too-eager recipient thereof.

Information Bill

It is considered good practice to show all or nearly all of the following data:

Name and address of company.
Where bills may be paid.
Name and address of customer.
Customer's account number or other account identification.
The date the bill was issued.
The date on which the discount expires.
Actual dates of present and previous meter readings.
Present and previous meter index.
Total kilowatt-hours used.
Kilowatt-hours charged at each rate.
Gross bill.
Discount.
Net bill.
Unpaid previous bills.

The addresses of local offices, stores and other authorized collection agencies may also be shown. Bills covering more than one month's service should be plainly marked.

Rate Schedules on Bills

Since it is impossible to check the computation used in determining the total bill without the rates, they are usually printed on the back of the bill. The discount or additional charge must also be quoted. If the rates vary in different sections it is difficult and unpolitic to show them unless separate bills are used for each section of the territory. If the schedule is such that a few sentences of explanation will enable the customer to understand the application of the rate, it seems desirable to show it on the bill. If a brief explanation will not serve the purpose, such information must be omitted.

Unpaid Bills and Merchandise Items

Space must be provided for showing previous unpaid bills. Companies which make a practice of billing merchandise payments on the service bill must also provide space for such entries.

Messages on Bills

It is not uncommon to include a small merchandise advertisement on the monthly bill, but opinion on this matter has not been crystallized.

Bills are also used as a medium for carrying messages such as warnings against permitting unidentified company representatives to enter premises, instructions as to how to read meters, announcements of store openings, changes in rates, new policies, or service messages designed to promote public relations.

**Service suggestion, Customer Relations Section, N.E.L.A.*

Four Cardinal Points in Rural Service

1. Rates especially developed to meet rural conditions.
2. A rural service department where the responsibility for the development is placed.
3. Minimum line construction costs consistent with economical upkeep.
4. Development of a selling program which will place reliable information in the farmer's hands.

Dr. E. A. White,
Director National Committee on the Relation of Electricity to Agriculture.

Letters from Our Readers

Motor Starting Current Vs. Lighting Flicker

To the Editor of the Electrical World:

I do not believe that Mr. Johnson is in real disagreement in regard to my article, upon which he comments in the April 28 issue of the Electrical World. In his illustration the motor at M has but a two-way feed from each of two directions along the mains AA', although at the points A and A' there is a four-way feed resulting from the network of three sets of mains and a transformer bank at these points. Mr. Johnson combines all the cable and transformer impedances from all the included banks to the motor M; that is, he sets up the condition equivalent to a one-way feed.

Applying the approximate formula $IR \cos \phi + IX \sin \phi = 2$, substituting $R = 0.00303$ and $X = 0.00696$ ohms, the value of I becomes 276 amp. for 15 per cent power factor, as against 270 amp. as determined by him.

For two-way feed Mr. Johnson's values of combined impedance would be doubled and the value of I halved, but since a two-way feed is now being considered the allowable motor current becomes $2 \times I/2 = I$ as before. Mr. Johnson has merely made too literal an interpretation of my memorandum.

H. L. Wallau,
Electrical Engineer.
Cleveland Electric Illuminating Company.

Senility, Not Sensibility

To the Editor of the Electrical World:

In setting up the copy of my letter appearing on page 1302 of your June 16 issue the printer has thrown my thought 90 degrees out of phase by using the word "sensibility" instead of "senility." Of course it is not necessary to point out that "sensibility" means mental receptivity, discernment, etc., while "senility" is a "horse of another color."

H. W. Young,
President.
Delta Star Electric Company,
Chicago, Ill.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Progress in the Burning of Coal.—A. G. CHRISTIE.—As the result of an examination and analysis of contemporary practices in the combustion of coal the author has arrived at a number of conclusions regarding future developments in this field. Several influences are credited with bringing about the recent progress in the combustion of coal, namely, increased furnace size and better combustion conditions, increased furnace temperatures, a better appreciation of the effect of radiant heat transfer, a better appreciation of equipment and furnace requirements for various coals, improvements in stoker design, improvements in powdered coal systems and better instruments and improved furnace control. It is anticipated that furnace sizes will not be decreased and may be increased. Higher fuel-burning capacities of furnaces will be secured by better firing methods, further mixing of gases in the furnace and, in the case of stokers, improved methods of distributing air to the fuel bed. The use of preheated air will be extended, according to the author. New furnaces will aim to secure the highest furnace temperatures possible to assure rapid and efficient transfer of heat. These and many other essential fundamental characteristics have been considered by Professor Christie. — *Engineers and Engineering*, May, 1928.

High-Pressure Steam Boilers.—G. A. ORROK.—The lines of further investigation which apparently offer the greatest possibilities in the future design and construction of high-pressure steam boilers have been completed by the author. Among the factors discussed are: The effect of tube inclination; the circulation problem, releasing surface and steam space; safety in operation; increase in capacity; boiler materials, temperature margins, and stresses in superheater tubes, riveted drums and headers. It is developed that a high-pressure boiler must consist largely of banks of tubes; headers in great variety are available up to at least 1,400 lb. pressure; drums must be of small diameter and should not contain over 10 per cent of the water content of the boiler; below 1,000 lb. there is no need of employing alloy steels, but above that pressure such steels are available and should be used if the temperature margins so require; for superheats higher than 800 deg. alloy steels are indicated; twenty or more different designs of boilers are successfully operating at pressures of 500 lb. and over, six at 1,000 lb. and one at 2,000 and over, and enough work has been done to indicate that their efficiencies are comparable to those obtained with boilers of lower pressure.—*Mechanical Engineering*, June, 1928.

Fuel Handling and Ash Disposal.—J. R. MCCAUSLAND.—A discussion of methods and equipment which may be used for the handling of fuel and ash in electric generating stations has been offered, utilizing the practices of one large utility system as a basis. The observations consist largely of experience data obtained at three large tidewater stations utilizing bituminous coal. The author has considered shipping conditions, unloading equipment, a description of the individual plants involved and the facilities available at each, coal storage, prevention of spontaneous combustion and similar factors.—*Mechanical Engineering*, June, 1928.

Generation, Control, Switching and Protection

Automatic Generating Station in Japan. — U. VETSCH. — The paper describes a hydraulic generating station located in a mountainous, inaccesible place and designed, for this reason, to be fully automatic. Starting and stopping are accomplished by closing the oil switch at the other end of the transmission line, which ties the automatic station to the distant base plant at Shizumo. One 2,000-kva. vertical shaft, 11,000-volt, 900-r.p.m. generator is installed, driven by a horizontal plane spiral turbine. A relatively small number of auxiliary relays were added to the otherwise standard equipment of the station. Starting and stopping operations are carried on in the same sequence as is customary for manual operation, but the individual steps are mechanically and electrically so interlocked as to prevent the next step unless the previous one has been correctly finished. To avoid the installation and care of a storage battery, the main generator carries on its shaft not only the exciter but also a small auxiliary direct-current generator for the controls. An automatic synchronizer closes the main breaker in the station when potential and phase are correct. Overload, overspeed and temperature relays are provided for the protection of the generator.—*Brown, Boveri Mitteilungen*, May, 1928.

The Cost of Electrical Switchgear.—H. TRENCHAM.—It is the contention of the author that the cost, and consequently capital investment, involved in the switching devices used by electric utilities is far too high and he has accordingly offered suggestions toward the reduction of this essential but unproductive item in station design. While a number of specific suggestions involving standardization and minimization of unnecessary items of equipment are offered, a consideration of the technical difficulties involved is recognized.—*Electrical Engineer (Australia)*, April 16, 1928.

Transmission, Substations and Distribution

Impregnation of Wooden Poles.—R. NOWOTNY.—According to the process described by the author a mixture of sodium-fluorate and nitrated phenol is injected into the endangered zone of a wooden pole by means of a special tool which is a combination of hammer and injection syringe. The point of the tool is driven about 1½ in. deep into the wood and a few cubic centimeters of the antiseptic liquid is discharged into the pole. This is repeated at numerous points all around the shaft. Tests made several months after this treatment indicated that the injected chemicals spread out by capillary diffusion a considerable distance up and down from the point of application. A number of European telegraph, telephone and power companies have adopted this impregnation method with good results.—*Elektrotechnik und Maschinenbau*, April 29, 1928.

Rigorous and Approximate Theories of Electrical Transmission Along Wires.—JOHN R. CARSON.—The elementary theory based upon concepts of transmission phenomena completely determined by the self and mutual impedances of the conductors and the self and mutual capacities, together with the dielectric leakage, are seen by the author as not altogether adequate because of admitted approximation. The first defect is recognized as being a transmission phenomena correctly represented only at some distance from the physical terminals of the system or at some distance from points of discontinuity. It is also stated that when conductors of large cross-sections or the ground form part of the transmission system the elementary theory becomes inadequate. The problems here dealt with have been stated as, first, to investigate the conditions under which the specifications of the system by means of its self and mutual impedances is valid and, secondly, to provide a general method for calculating these circuit parameters from the geometry and electrical constants of the system. — *Reprint B-289 Bell Telephone Laboratories, Inc.*

Units, Measurements and Instruments

Various Methods of Connecting Indicating Wattmeters.—JOHN AUCHINCLOSS.—A discussion of suitable methods for connecting indicating wattmeters for three-phase, three-wire circuits; three-phase, four-wire circuits; single-phase and polyphase instruments; various combinations of current and potential transformers, and certain power-factor and voltage-balance considerations are offered by the author in a technical

evaluation of possible practices. It is stated that since no billing is done with indicating wattmeters, operating companies sometimes sacrifice accuracy for the sake of avoiding added investment in large instrument transformers. This is recognized as a justifiable practice in some cases, but is not recommended without a thorough understanding of the accuracies inherent in such combinations and in their application.—*General Electric Review,* May 1928.

Totalizing the Output of Two or More A.-C. Circuits.—The installation and operating requirements that must be satisfied for the totalizing of the output of two or more alternating-current circuits on one watt-hour meter by paralleling the secondaries of current transformers are offered in this report. This method of measurement has been devised to meet certain peculiar conditions existing in various parts of the country. It is stated that it has been considered advisable to make a study of the method and to point out some of the limitations and requirements that must be satisfied in its application. The effect of equally and unequally loaded circuits, current-transformer secondary connections and secondary burden are all discussed in detail. The general problem of the determination of correction factors for a combined installation of this type has been thoroughly covered and the procedures are included for the determination of these factors by actual test and by calculation. Test data substantiate the conclusions determined in this investigation.—*Serial Report National Electric Light Association,* May, 1928.

Illumination

Four Variables of the Visual Threshold.—Percy W. Cobb and Frank K. Moss.—At least four variables are recounted by the authors as entering into the description of any visual object. Two of these are recognized as photometric, namely, the brightness of the object and that of its ground. The third is the size of the object expressed in visual angle, and the fourth is the time during which the image of the object acts upon the retina of the eye. The object of the present investigation has been to determine the inter-relations of these factors by a uniform method over wider ranges than has previously been undertaken. The specific objects to be determined were: The brightness, closely approximated by the brightness of the background upon which a dark object is exposed when at its threshold value; the contrast ratio, which is the ratio of the difference between these two, due to the background brightness; the visual angle under which the object is seen, and the exposure time.—*Journal of the Franklin Institute,* June, 1928.

Daylight, Artificial Light and Artificial Daylight.—J. S. Dow.—An analysis of the merits and drawbacks of the three types of illumination ordinarily available has been offered in this discussion, in which the results of a comprehensive research investigation have been included. Comparisons and differences between natural and artificial light, the contrast effect of the bright sky, the differences in the visible and ultra-violet spectrum, requirements of different classes of buildings, the transition from natural to artificial light, the relative intensity of illumination needed by natural and artificial light, influence on acuteness of vision, architectural considerations and several psychological effects have been considered in this discussion.—*Journal of Good Lighting (England),* June, 1928.

Heat Applications and Material Handling

Storage Batteries in Relation to Modern Supply of Electric Lighting and Power.—E. C. McKinnon.—It is the author's prediction that storage batteries will be in wide demand for innumerable purposes for many years. New applications are foreseen as continually arising and it is stated that no equally reliable stand-by source of electrical energy is at present known. The author reports a definite trend in Great Britain toward the running of the supply station's power auxiliaries from a direct current supply and the installation of storage batteries of adequate capacity to carry the station's power load for a period varying from twenty minutes to one hour. This insures an unfailing supply of power for maintaining the circulating water supply, operating overhead cranes, a proportion of the stoker motors, switch control and the essential pilot lighting. A number of features have been considered in this discussion, including battery room design, battery design, tests, special applications, special methods of charging, the supply of materials for the construction of batteries and a consideration of the future prospects for use by electric light and power companies.—*Journal of the Institute of Electrical Engineers (England),* May, 1928.

Telegraphy, Telephony, Radio and Signals

The Design and Distribution of Wireless Broadcasting Stations for a National Service.—P. P. Eckersley.—Great Britain was the first nation to give a single authority the responsibility for the conduct of a national service of broadcasting. This paper deals with some of the aspects of the underlying problems in the distribution and design of broadcasting stations to give a national service. The endeavor to present a comprehensive view of the situation precludes the possibility of a quantitative discussion. Each of the sections of the paper might well be used as a basis for a more detailed discussion, but a general exposition of the subject is offered here. The author suggests that peculiar interest attaches to the science of broadcasting, as the subject comprises not only technical but also psychological problems. No other technical public service depends for its successful operation upon material and operation supplied by relatively unskilled persons under no authority or disciplined direction.—*Journal of the Institution of Electrical Engineers (England),* May, 1928.

Miscellaneous

Combined Light and Suction-Fan Trap for Insects.—W. B. Herms and R. W. Burgess.—An insect trap consisting of a 300-watt lamp, a reflector, a small electric fan, a collecting sack and a wind vane, for directional location of a protective windshield, has been utilized with conspicuous success in an insect-infested lake section of California. As a measure of the efficiency of this device it is reported that in two hours of use 11 lb. of gnats were trapped and destroyed. During a season more than 156 lb. of the insects were similarly eliminated. The device is simple, being capable of home-made construction, and may be placed in any location where electricity is available. The energy requirement is low, consisting of the 300-watt lamp and a small electric lamp motor.—*Electrical West,* April 1, 1928.

Photomicrographic Study of Rough or Nodulized Electrodeposited Nickel.—C. Upthegrove and Edwin M. Baker.—Nodulized or rough nickel deposits are undesirable in that they cause rejections of plated work, increase the difficulty of buffing and lower the protective value of the plate. A photomicrographic study was made of some excessively nodulized deposits. This study indicated that the nodules are apparently not related to imperfections in the base upon which the plating is done nor to the method of cleaning, as the nodulized growth may start after metal has been deposited to some thickness. In general, it is concluded that the nodules are a result of suspended particles in the bath which may come in contact with the surface of the metal after deposition has started. The indicated remedy, therefore, is the maintenance of more nearly clear solutions.—*Report American Electrochemical Society,* April, 1928.

Are Electrons Waves?—C. J. Davisson.—Circumstances have been found, according to the author, in which electrons do not appear as particles at all, but as waves. The results of a number of experiments in which a narrow stream of electrons has been directed against the base of a nickel crystal and the conditions under which a sharply defined stream of electrons leaves the crystal have justified this conclusion. Observations were also made with reflected-electron phenomena in connection with a target of ordinary polycrystalline nickel. Wave lengths and velocities of electrons are developed as a result of several phases of the determinations made. On the other hand, it is not contended that electrons are waves, although they have the characteristics and qualities indicated in this research.—*Journal of the Franklin Institute,* May, 1928.

News of the Industry

San Francisco Valuation Figures Miles Apart

Pacific Gas & Electric and Great Western Companies Value Distribution Systems Plus Severance Damages at $97,000,000, City at $28,200,000

THE marked difference of opinion long known to exist as to the valuation of the San Francisco electrical distribution systems of the Pacific Gas & Electric Company and the Great Western Power Company between those two companies on the one hand and the City and County of San Francisco on the other hand is clearly brought out in the briefs filed June 15 with the California Railroad Commission. The Pacific Gas & Electric Company sets $67,000,000 as the value of the property which the city is seeking to acquire for the distribution of electrical energy developed by the Hetch Hetchy project. The city's figure is $18,894,005, including severance damages put at $457,360. The Pacific Gas & Electric Company sets its severance damages at $27,000,000. The Great Western Power Company has set $30,000,000 as the valuation of its properties in question, while the city believes that $9,306,537 is an equitable valuation of the same properties.

The figures given relate to the value of the properties on Feb. 11, 1924, the date the city filed its petition to the Railroad Commission "to fix and determine the just compensation to be paid by the City and County of San Francisco." Hearings and surveys have extended over the last four years. The actual hearings have covered a period of approximately three years and numerous witnesses of national standing have testified. Among the most prominent of these are Dr. Arthur T. Hadley, former president of Yale University; Alex Dow, president Detroit Edison Company, through whose testimony to the effect that he would have been willing to organize a syndicate in 1924 and purchase the property involved for $40,000,000 the Pacific Gas & Electric Company established the valuation of its property, and Sidney Z. Mitchell, president Electric Bond & Share Company, New York, whose estimate of the market value of the property on Feb. 11, 1924, has been used as its valuation figure by the Great Western Power Company.

The two companies contend that in arriving at the valuation figures a number of major factors should be taken into consideration, such as reproduction cost new, market value as it would be reflected in the remaining properties after the San Francisco holdings had been withdrawn, added difficulty in obtaining money because of the loss of the best-paying part of the entire system, going-concern value, and revenue loss through loss of urban consumption of energy in winter when there is slack demand for energy in rural districts.

On the other hand, the city holds that the claims presented by the companies are grossly extravagant and exaggerated and that the basic theory of damage to the remainder of the system and business is unsound and cannot be supported by principles of law applicable to eminent domain proceedings.

Regardless of the decision in the present case, another series of hearings must be held to determine the value added to the properties by expenditures since 1924. The expenditures of the Pacific Gas & Electric Company are said to have been between $12,000,000 and $15,000,000 and those of the Great Western company between $7,000,000 and $9,000,000.

Denver Greets the Institute

Summer Convention in Colorado's Capital Adds Another to the Technical and Social Successes of the A.I.E.E.—Five Americans Made Honorary Members

DELEGATES from forty states attended the summer convention of the American Institute of Electrical Engineers in Denver on June 24 to 29. More than five hundred engineers listened to excellent technical programs, enjoyed the entertainment and were delighted by Rocky Mountain scenery. On Monday the section and branch delegates discussed their affairs. At the business meeting on Tuesday important announcements were made and formal announcement of the new officers elected was made. The mail ballot resulted, as usual, in indorsement of the official slate as follows:

President—Rudolph F. Schuchardt, electrical engineer Commonwealth Edison Company, Chicago.

Vice-Presidents—Northeastern District, E. B. Merriam, General Electric Company; New York City District, H. A. Kidder, Interborough Rapid Transit Company, New York; Great Lakes District, W. T. Ryan, University of Minnesota; Southwest District, B. D. Hull, Southwestern Bell Telephone Company, Dallas; Northwest District, G. E. Quinan, Puget Sound Power & Light Company, Seattle.

Managers—A. E. Bettis, Kansas City Power & Light Company; J. Allen Johnson, Niagara Falls Power Company; A. M. MacCutcheon, Reliance Electric & Engineering Company, Cleveland.

Treasurer—George A. Hamilton, electrical engineer (retired), Elizabeth, N. J.

The board of directors announced the election of five honorary members of the Institute. These are Thomas A. Edison, John J. Carty, Michael I. Pupin, Ambrose Swasey and Elihu Thomson. Their election is in conformity with a new policy, they being the first honorary members who reside in this country.

In his presidential address Bancroft Gherardi talked on the topic "Civilization and the Engineer." He traced the growth of science from the time of Galileo and Newton and showed that power and machinery had enabled mankind to produce more than the primary necessities of life. Through this excess production capital was created, and capital made possible leisure for cultural development. President Gherardi pointed out that culture could be sustained only by widely distributed material prosperity and that the engineer and his works contributed many things to the spiritual progress of the world.

The technical sessions afforded opportunity to hear and discuss notable technical papers. One session was devoted to recent investigations of surges on transmission lines. Several utility companies presented data taken from surge recorders and stated the conclusions arrived at. In general high-voltage surges were found to occur with values ten to twelve times normal because of lightning and four to five times normal because of switching. No definite conclusions could be made from the data as to the effective work of ground wires, nor were the data sufficiently accurate and numerous to determine the wave fronts, types of waves and other quantitative results. More experimentation was announced as an industry program.

Another feature session dealt with the use of high-speed circuit breakers in railroad electrification. Several papers described design characteristics of breakers of the latch and magnetic holding types and discussed the details of these breakers as applied in railway service. In general the object is to interrupt a fault as quickly as possible in order to minimize inductive effects and damage to apparatus. An active discussion occurred as to the relative merits of oil and air breakers and as to the relay arrangements used to get selective breaker operation.

The technical committee chairmen presented reports of work done during the year and gave a résumé of the status of the art in their respective fields of activity. Notable progress was evidenced in many lines of research and

development. The use of structural-steel welded materials is increasing rapidly. Many improvements have been made in transformers and in other machinery. In lighting there has been a refinement in design and an extension of application because of the trend toward decorative illumination. In electrochemistry and electrometallurgy many new applications were recorded.

The use of graphite in dry cells, commercial growth of electrolytic zinc plants, chromium-plated materials and new devices in heat-treating of materials were some of the topics brought up. Standardization has been used in several types of equipment and much will be presented next week.

At other technical meetings a wide variety of topics were presented and discussed, including welding, elevators, carrier current, arcs and transmission-line design. All the technical sessions were well attended. A complete report will be presented.

The whole convention enjoyed an all-day trip through Denver's parks and among the snowclad mountains. A dinner-dance was given on Wednesday evening and a theater party was scheduled for the outdoor theater on Thursday. With good weather, a delightful environment and admirable local committee arrangements, the summer meeting at Denver scores a notable success.

Tennessee and Arkansas Bureaus Investigated

Federal Trade Commission Still Concerned with Utterances of State Information Committee Directors—Kansas Also Heard From

MORE letters from J. B. Sheridan, director of the Missouri Committee on Public Utility Information, were placed in evidence when he again went on the stand at Washington on Thursday, June 21, in the investigation into the public utilities which the Federal Trade Commission is making. These dealt, among other things, with the Associated Press and its attitude toward the committee's publicity matter, which Mr. Sheridan at one time thought unfavorable, but which subsequently, he thought, changed; with the expressed approval of Governor Sam Baker when he was Superintendent of Public Schools in Missouri of a plan to distribute public utility pamphlets in the schools, followed by a refusal to give the proposal formal indorsement, and with the political agitation against the utilities promoted by what Mr. Sheridan called the "Walsh-Norris-Pinchot-La Follette crowd."

The witness in letters to Thorne Browne of the Middle West Division of the National Electric Light Association said that he was convinced that the public utility industry should "clean house" and rid itself of companies which did not play the game squarely, recommending publicity as the means of carrying out the idea.

Guy P. Newbern, director of the Tennessee Public Utility Information Bureau, testifying the next day, asserted that his bureau had distributed considerable printed matter opposing the Muscle Shoals project. Letters introduced at the hearing indicated that a close watch was maintained on newspaper editorials and articles on this subject. In a report to his executive committee, Mr. Newbern described how at a meeting of public utility men in Washington in April, 1926, "plans were made for a big educational campaign on the Muscle Shoals bids of the associated power companies." Mr. Newbern testified that pamphlet supplied to the bureau by the National Electric Light Association were distributed in large numbers to Tennessee schools, newspapers, libraries and public officials. Ten thousand sets of three pamphlets each were placed in schools last year, one of the exhibits showed. Mr. Newbern said that his bureau collected and disbursed $18,000 in 1927. There had been no survey of textbooks in Tennessee.

Details of the utilities' fight in behalf of the state utility commission in Tennessee were revealed in a speech by Ross Murphy, former director of the bureau, placed in the record during examination of Mr. Newbern. Reviewing a controversy over that commission, Murphy told utility men "only the concerted efforts of every public utility in the state" saved the commission in the Senate after the House had passed a repeal bill, the bill being set aside by a vote of 18 to 11.

On Tuesday, June 26, Earle W. Hodges, now connected with Henry L. Doherty, New York, but formerly director of the Arkansas Public Service Information Bureau, was a witness. A transcript of a speech alleged to have been made by him in 1923 at an N.E.L.A. meeting in New York was shown to him. In this transcript Mr. Hodges was quoted as saying: "If we do have any propaganda (and I don't like that word at all, for it is one of the Kaiser's favorites), we so conceal or 'sugarcoat' that propaganda with boosting that it is generously entered into and got back of by all of the chambers of commerce, civic clubs, men's and women's organizations over the state." Mr. Hodges could not remember using these words.

Rex I. Brown of Little Rock, secretary-treasurer of both the Information Bureau and the Arkansas Utilities Association, refused to admit that the *Dixie Magazine*, devoted to stimulating interest in the state's resources, had been subsidized. In the course of two and a half years, he said, $8,719 had been paid the magazine for subscriptions and advertisements and as loans. In no instance had he requested the publication of any article in the magazine.

Further questions brought from Mr. Brown the statement that no textbook survey had been undertaken in Arkansas, as far as he knew, and no effort had been made to check up on the amount of utility news printed in the Arkansas newspapers.

Observers in attendance at the hearings on Wednesday were impressed with the clear, straightforward testimony of H. Lee Jones, the director of the Kansas bureau. He had a ready and positive answer to each question, and it was apparent that he was proud of the work his bureau had done and had no doubt as to the soundness of the doctrines he has preached and the wisdom of the methods used to further them. Mr. Jones insisted that no advertising was placed with any newspaper with any thought or desire to influence its editorial policy. The support of any editor who could be influenced by advertising, he declared, would not be worth having. His committee acted on that assumption and placed its advertising on a strictly commercial basis.

Mr. Jones told of the co-operation of Kansas utilities with the state authorities, state educational institutions and agricultural organizations in efforts to speed the extension of electric service to the farms. He stated that 13,000 copies of a pamphlet setting forth fundamental facts on the utility industries had been distributed to schools and that an advertisement had been carried in one issue of the *Kansas Teacher* in which it was represented that the booklet would be of value in connection with courses in physics and civics. There was no concealment of the source of the material. Those interested were asked to apply to the Information Bureau of Kansas Public Service Companies.

Indiana men were under subpœna for Thursday's session.

Wisconsin Accountants Stage Meeting of Wide Scope

Three addresses of general interest to all utility men as well as to the public were made at the annual two-day convention of the Accounting Section of the Wisconsin Utilities Association in Milwaukee, June 21-22. The interest they aroused was undoubtedly responsible for attracting the largest attendance ever recorded by this section. A total of 96 accountants were registered, as against 56 last year, and at one of the sessions more than 150 utility men were in the audience.

Lewis E. Gettle, chairman of the Railroad Commission of Wisconsin, denounced in scathing terms the Hearst newspaper propaganda and the attempts that have been made to misrepresent his own attitude in opposing the Walsh resolution. Mr. Gettle represented the Wisconsin association as chairman at the Washington hearings and was accused of being "dragged there by the power interests." His address was a reasoned defense of state versus federal regulation.

Paul M. Binzel, Milwaukee, manager of the buying department of Morris Fox & Company, investment bankers, stressed earning power and minimized equities as a proper basis for the issuance of utility as well as industrial securities. He also argued against the use of reproduction cost as a basis for rates or security issues.

Karl F. McMurry, certified public accountant, Madison, presented records from reports filed with state government departments showing comparisons on rates and population served between privately owned and municipally owned electric systems in Wisconsin. These records, he said, prove that the most economical electric service is furnished by the large privately owned companies.

Two accounting papers that provoked discussion were presented by A. A. Meisenheimer, general storekeeper of the Milwaukee Electric Railway & Light Company, and S. A. Bialecki, credit manager of the Milwaukee Gas Light Company. Mr. Meisenheimer explained in detail the adaptation of tabulating machines to the 57 classes of stores accounts of the company. Mr. Bialecki described methods used to keep losses on bills for service and merchandising down to one-tenth of 1 per cent.

Louis T. Smith, assistant secretary of the Milwaukee Gas Light Company, was elected chairman of the section. A. J. Bohl, assistant secretary-treasurer Milwaukee Electric Railway & Light Company, was elected vice-chairman.

Purchases and Mergers

The New England Power Association has acquired the controlling interest in the Quincy (Mass.) Electric Light & Power Company, which serves 19,000 customers in the metropolitan district adjoining Boston. The company had gross earnings of $857,000 in 1927.

On Tuesday the Consolidated Gas, Electric Light & Power Company obtained from the Maryland Public Service Commission the right to acquire the entire property and assets of the Northern Maryland Power Company at a cost of $590,875 in cash and, in addition, either a part or all of a deferred obligation amounting to $230,400. This ends the fight recorded from time to time in these columns between the Baltimore and the Philadelphia light and power interests to absorb the Havre de Grace utility. The Baltimore company, when it gets control, will have the right to operate in every part of Harford County except one election district.

Holders of more than a majority of the stock of the Harrisburg Light & Power Company voted this week to sell their interests to the Pennsylvania Power & Light Company in accordance with the proposal already noted.

Sale of the Georgetown (Ky.) Water, Gas & Electric Company, owned by Mrs. R. W. Nelson, to the International Utilities Corporation, holding company of the Lexington Utilities Company, is announced.

Sale of the municipal electric system of Summerfield, Kan., to the Iowa-Nebraska Power Company is announced. Summerfield has been buying its energy wholesale from the municipal plant at Pawnee City, Neb. A transmission line is under way.

Custer City, Okla., has voted to sell its municipal light and power plant to the Southwestern Light & Power Company.

Norfolk, Ark., has sold its lighting plant to the Arkansas Power & Light Company. The new owner has acquired a controlling interest also in plants at four other towns in the northern part of the state—Cotter, Mountain Home, Gassville and Flippin.

The Georgia Power & Light Company has purchased the electric light plant at Pearson and will build a transmission line from Cogdell to that place.

The Gulf States Utilities Company, Lake Charles, La., has offered $125,000 for the lighting, waterworks and ice plants of Vinton, La. The voters are to decide.

The Gulf Utilities Company, New Port Richey, Fla., has acquired the Cedar Keys (Fla.) Light & Power Company, Cedar Keys, Fla. The Florida Public Service Company, Orlando, Fla., is arranging to buy the Mount Dora municipal power plant.

McGraw-Hill and Shaw Company Merge

Consolidation Affects Large Number of Engineering and Industrial Papers—Shaw and McGraw-Shaw Companies Become Divisions of McGraw-Hill

A CONSOLIDATION affecting two large publishing interests has just been brought about by the merger of the McGraw-Hill Publishing Company, Inc., of New York and the A. W. Shaw Company of Chicago.

The Shaw organization publishes the *Magazine of Business, System* and the *Industrial Distributor and Salesman*, while the McGraw-Hill organization is the publisher, either directly or through subsidiary and affiliated companies, of more than twenty leading business papers, including the ELECTRICAL WORLD, and of engineering and business books. The two companies have had a close relationship since last fall, when they jointly formed the McGraw-Shaw Company, which publishes *Factory and Industrial Management* and *Industrial Engineering*.

A. W. Shaw will continue as chairman of the board and James H. McGraw will become president of the A. W. Shaw Company. Mr. Shaw will also become a director of the McGraw-Hill Publishing Company, Inc., and will continue as president of the McGraw-Shaw Company. Wheeler Sammons will become a director and member of the executive committee of the McGraw-Hill Publishing Company and senior vice-president and general manager of the A. W. Shaw division of the business, which will be known as the "A. W. Shaw Company, a division of the McGraw-Hill Publishing Company, Inc." The McGraw-Shaw Company will also be operated as a division of the McGraw-Hill Publishing Company.

Two reasons for the merger are stressed by the officers of the merging companies. The magazines of the two organizations are complementary in character. The Shaw papers cover business broadly, giving the business man an understanding of what is going on in all branches of trade, industry and finance. Their service is extensive in character. The McGraw-Hill service, on the other hand, is intensive. Its magazines give a highly specialized service to given major industries and to related industrial groups. Thus the consolidated companies serve the business man in both his general and special business interests. The second reason is the very evident economy and increased effectiveness of consolidated operation, enabling a superior service to be rendered to the whole sweep of American business. Mr. McGraw said:

"Mr. Shaw's organization and ours have been working closely together for more than a year and have seen the benefits of consolidated effort between groups having widely different publishing experiences. The Shaw company has had a signal success in publishing magazines of large circulation and of broad appeal to the industrial and business worlds. The McGraw-Hill company has intensively served by specialized publications the leading engineering industries and the trade channels for distributing their products.

"It was apparent that the McGraw-Hill group of industrial and trade papers would have a new way of carrying the message of common business problems if it was allied with papers like the *Magazine of Business* and *System*. At the same time these publications would be immeasurably strengthened by being tied in with and assisted by the great editorial staff of over one hundred and thirty industrial and business specialists who edit the McGraw-Hill papers. There were also conspicuous opportunities for more effective subscription and advertising work and for economies in every phase of publishing. The logic of these opportunities could not be escaped. The merger has been the result.

"Though every paper of the merging companies will be strengthened by the consolidation, and thus render greater service to its readers and advertisers, the most conspicuous result will be the new and strong position of the *Magazine of Business*. Through Mr. Shaw's vision and courage it is a magazine of strength, standing and influence. It now becomes the capstone of the virile group of papers and the other publishing activities of the McGraw-Hill company, thus extending the scope of the latter organization to the whole range of American business. At the same time, drawing on the intimate contact with trade and industry of the large corps of McGraw-Hill specialist editors, it will speak with unexampled authority on the problems of business. It will be able to render an outstanding service to the business men of America by its authoritative information, its expert interpretation and its fearless advocacy of sound business policies. It will fight for the interests of business, but it will place in an equally important position the responsibility of business to the public. It will, in a word, stand for true business statesmanship."

Mr. Shaw expressed his gratification over the merger in a similar vein.

Northwest Men for Proclaiming Facts

Portland Convention Indorses Principles of National Committee on Public Policy—All Sections of Geographic Association Hold Excellent Sessions

DETERMINATION to continue to disseminate facts about the electrical industry as widely as possible was repeatedly expressed at the twenty-first annual convention of the Northwest Electric Light and Power Association, held at Portland, Ore., June 19-22. Urged at the opening session by the president of the association, A. C. McMicken, and two of the principal speakers—Franklin T. Griffith, president Portland Electric Power Company, and Preston S. Arkwright, president-elect of the N.E.L.A.—this determination was voiced in a resolution passed at the executive session "vigorously indorsing" the principles laid down by the public policy committee of the national association at Atlantic City answering propaganda charges.

Making a plea for a continuation of state regulation as opposed to federal regulation of electric utility companies, J. M. Thompson, member of the Public Utilities Commission of Idaho, attacked the theory that in crossing state lines electrical energy becomes a commodity in interstate commerce and therefore escapes the jurisdiction of any state commission. He showed that such energy, before it can serve any useful purpose in the state importing it, becomes commingled with all the other electrical energy generated in that state and takes on a purely local character, which brings it under the jurisdiction of the commission of the importing state. Prior to leaving the exporting state it falls under the jurisdiction of that state's regulatory body in that the property used in such export should be deducted from the property used by the exporting company for purely local distribution in determining that company's rate base in the exporting state. Therefore there is no energy that is not at all times within the jurisdiction of some state commission.

At the session devoted to the Commercial Section C. E. Greenwood, commercial director N.E.L.A., discussed the results of the recent industry sales conferences, through which, as already explained in the ELECTRICAL WORLD, a decision has been reached to study the possibility of a national advertising campaign. Eloise Davison, home economics adviser, N.E.L.A., told of the work of her department.

Reviewing accomplishments in the field of farm electrification and looking forward to greater things, J. T. Jardine, chairman of the Oregon committee on the relation of electricity to agriculture, pointed to agriculture's trend toward industrialization as involving "joint responsibility and joint interest" on the part of all concerned.

In the engineering sessions J. B. Fisken, Washington Water Power Company, Spokane, outlined the history of accident prevention work in industry, called attention to the lack of progress in this work in the electrical industry, outlined a safety program, analyzed accident costs, and closed with a plea that the industry give more attention to the subject.

Discussing phases of electrical development in Great Britain, L. A. McArthur, Pacific Power & Light Company, Portland, stated it as his opinion that the trend in that country was away from government operation and toward private operation.

For the Accounting Section, Chairman F. W. Brownell, Puget Sound Power & Light Company, Seattle, outlined a plan for broadening the scope of the section to include studies of a research nature both within and without the industry, not of a strictly accounting nature, but coming within the scope of the duties of the accounting executive. A study of taxation conditions in the territory during the past year had proved very valuable and would be amplified during the coming year.

Two trends respecting the absorption of securities of electric power companies have raised the point that greater care might be given to the form in which financial statements are published, according to Carl S. Dakan, University of Washington—first, the placing of utility bonds on the legal list for savings banks; second, customer ownership. Mr. Dakan had many suggestions looking toward standardization of terminology and method of presentation of financial reports with a view to eventually forcing the buyer to assume his fair share of the investment risk.

The effort of the Public Relations Section for the year had been devoted to interesting the rank and file of company organizations in informing itself about industry and company problems, and the convention program of the section was largely devoted to displaying the results of that work. Two public-speaking contests and three essay contests had been conducted within the member companies by committees of the section, and the winners of these contests presented their winning papers or talks before the convention.

Officers elected were: President, R. M. Boykin, Puget Sound Power & Light Company, Seattle; vice-president, L. M. Hibbard, Idaho Power Company, Boise; state vice-presidents: for Idaho, R. B. King, Idaho Power Company, Boise; for Oregon, George L. Myers, Pacific Power & Light Company, Portland; for Montana, W. B. McDonald, Mountain States Power Company, Kalispell; for Utah, P. M. Parry, Utah Power & Light Company, Salt Lake City; for Washington, N. W. Brockett, Puget Sound Power & Light Company, Seattle; treasurer, W. E. Best, Puget Sound Power & Light Company, Seattle; secretary, Berkeley Snow, *Electrical West*, Portland.

Registration was about 350, and a crowd of well over 500, the largest ever recorded at a session of this division's convention, heard the public relations program on the last day of the convention. Excellent entertainment was provided.

Canadian Convention a Big Social Success

Committee Reports and Formal Proceedings Play Subordinate Part in Four-Day Steamboat Trip Affording Profit Through Personal Intercourse

MANY of the 275 delegates on the four-day boat convention of the Canadian Electrical Association last week pronounced it the most successful which they had ever attended. The president of the association, J. B. Woodyatt, in his opening remarks, expressed the motive which guided the preparation and execution of the program. He declared that the chief value of a convention is the opportunity which it affords for men with related interests from widely separated territories to get acquainted with one another and compare problems and experiences. He emphasized the social value, saying that committee meetings throughout the year can accomplish better business results than discussions on the floor of a convention. Only three half days were allotted to committee reports, and they were presented with great dispatch, a few remarks on the outstanding accomplishments of the past year being concluded by reference to the printed reports for details.

The SS. *St. Lawrence*, on which the convention was held, made the trip from Montreal via the St. Lawrence and Saguenay Rivers to Port Alfred and return, allowing a full day's stop-over at Port Alfred for a 125-mile motor trip to the Aluminum Company's plant at Arvida, the Price Brothers paper mill at Riverbend and the Duke-Price hydro-electric plant at Ile Maligne. A stop-over at Murray Bay was made for sports and the banquet.

Aside from the pronounced social character of the convention, it was notable in that executives of the utility regulating commissions were invited to attend for the express purpose of seeing that "utility men are not so diabolical as they are pictured," as Mr. Woodyatt phrased it. Four members of the Quebec Public Service Commission, a member of the Electrical Commission of Montreal and a member of the Ottawa Board of Railway Commissioners attended. The Canadian Engineering Standards Association and Electrical Standards Laboratory were also represented.

R. J. Wensley demonstrated "Televox," the "electrical man," and R. Treat presented a paper on methods of providing the most reliable transmission service.

P. S. Gregory, assistant to the vice-president of the Shawinigan Water & Power Company, was elected president for the coming year. H. M. Lyster continues as secretary of the association.

Neff and Holloway Address Agricultural Engineers

Assurances that the utility companies will do whatever is necessary to extend 24-hour electric service to the farms of the country just as they have extended it to all villages and hamlets were given the American Society of Agricultural Engineers by G. C. Neff, general manager of the Wisconsin Power & Light Company, who addressed that body at Washington on June 21. He declared that five hundred thousand farmers now are receiving 24-hour service.

E. A. Holloway, sales engineer Iowa Railway & Light Corporation, presented for reference a summary of a number of representative line-extension policies and rural rate schedules from which future policies may be more intelligently planned. The paper contained the complete rate schedule and rules for the extension of rural lines used by eight companies in as many states, arranged so that all can apply each schedule to a specific rural extension with accuracy. Three specific rural lines, one with three, one with four and one with five consumers per mile of line, were used for the application of each rate schedule.

R. W. Trullinger, assistant in experiment station administration, Department of Agriculture, read a paper on "Research in Rural Electrification, 1927," in which he came to the conclusion "that it is not always entirely sound to assume the perfection and economy of any particular kind of power and its corresponding equipment and to modify agricultural practices to permit the use of such power and equipment. The tendency, on the other hand, appears to be to determine the requirements of individual practices for power, and, with this as a basis, to lay down the specifications for power equipment which will best meet these requirements."

Want Large Delegation for Tokyo Congress

A nation-wide movement to marshal a large delegation of engineers from the United States to attend the first World Congress of Engineers, which will be held in Tokyo next year, is now under way. Maurice Holland, executive director of the American committee, reports that engineers and engineering societies in the United States will be organized into units to promote interest in the congress. As before announced, Dr. Elmer A. Sperry is chairman of the American committee and Herbert Hoover is honorary chairman.

A special committee on promotion and attendance has appointed Ernest Hartford of New York as its secretary. Mr. Hartford was authorized to organize local co-operative committees throughout the United States which would include the local sections of the founder engineering societies as well as independent local engineering clubs and societies. Through these groups it is expected that prominent engineers from many cities in the United States will be led to attend and participate in the congress. William E. Wickenden was authorized to communicate with the presidents of engineering colleges requesting their indorsement of and active aid in a plan to raise by subscription among the alumni a testimonial fund to send delegates to the congress. The delegates are to be designated by the proper officials of the colleges and to be members of their faculties.

The members of the committee on promotion and attendance are George W. Fuller, chairman; Edward Dean Adams, J. J. Carty, Howard E. Coffin, Gano Dunn, Bancroft Gherardi, John Hays Hammond, Charles H. Herty, Samuel Insull, Arthur D. Little, William Benson Mayo, Charles D. Marx, William C. Potter, E. Wilbur Rice, Jr., Charles M. Schwab, George Otis Smith, John F. Stevens, S. W. Stratton, Ambrose Swasey, Samuel M. Vauclain, H. H. Westinghouse and William E. Wickenden.

A.S.T.M. Annual Meeting at Atlantic City

Atlantic City was the scene this week of the thirty-first annual meeting of the American Society for Testing Materials. The president's opening remarks were made by Prof. H. F. Moore of the University of Illinois on Tuesday afternoon. Committee reports were, as usual, very copious. A summary of a few items of especial interest to electrical technicians and specialists is as follows:

The committee on magnetic properties (Thomas Spooner, chairman) submitted a proposed standardization of magnetic terms, units and symbols and recommended the advancement to standard of revised methods of test for magnetic properties of iron and steel at low inductions.

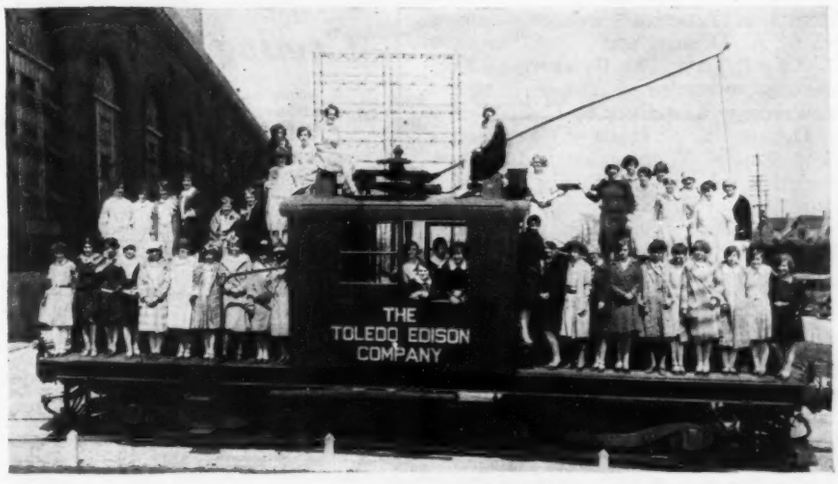
The committee on magnetic analysis (R. L. Sanford chairman) discussed the nature and present status of magnetic analysis and the relation of the committee to its development and pointed out the need for a larger number of investigators and a greater degree of co-operation in this field of non-destructive testing.

The incremental permeability method for the magnetic analysis of high-speed steel was discussed by W. B. Kouwenhoven and Julian D. Tebo, who presented results of tests on high-speed steel bars using a method based on incremental permeability in which a given magnetizing force is applied to the bar in question and the change in flux produced by an increment of magnetizing force is measured.

Endurance of high-speed cut-off tools in relation to magnetic and other measurements was the topic of Haakon Styri, who presented results of magnetic, electric, Rockwell hardness and duroscope readings on a number of standard cut-off tools hardened from different temperatures and used in cutting off rings of high-carbon chromium steel of about 200 Brinell hardness.

The committee on electrical insulating materials (H. S. Vassar, chairman) submitted, as tentative, methods of testing varnished-cloth tape, additional tests for laminated materials covering compressive strength and water absorption, and a complete revision of the tentative methods of testing molded insulating materials for resistance to impact, broadening the scope

Toledo Edison Pursues Its School Work Undismayed



THIS year's graduating class of the Notre Dame Academy, a school for girls at Toledo, Ohio, recently visited the Acme generating plant of the Toledo Edison Company and after a tour of inspection commandeered one of the electric locomotives for a ride about the coal-storage yards and switch tracks. As a result several girls expressed a determination to pursue the study of electricity through their college courses. Since the first of January the Toledo Edison Company has provided for this and other schools in its territory a series of talks and practical demonstrations dealing with the manufacture and distribution of electrical energy. Many letters of appreciation have been received by C. L. Proctor, vice-president and general manager, from the teachers and school boards of schools visited. Mr. Proctor will extend this educational service over a wider field, and plans have been perfected whereby upward of thirty thousand high-school and college students will hear these talks by Jan. 1.

to include ceramic and laminated materials. This committee recommended modification in methods of testing molded insulating materials, calling for a new form of tension-test specimen.

Camp Co-operation VIII Arranges Program

As already published, the seventh electrical league conference—Camp Co-operation VIII—held under the auspices of the League Council and sponsored by the Society for Electrical Development, will take place at Association Island, Henderson Harbor, N. Y., Aug. 2 to 7, inclusive. The many acceptances already received point to a well-attended meeting. In the business program, prepared under the direction of the League Council, headed by J. E. North, two main subjects have been kept in mind —(1) to report on plans, experiences, developments and results of league activities carried on during the past twelve months; (2) to give the league representatives a picture of changes in national thinking and working both inside and outside the industry. The wiring, lighting, appliance and industrial phases of league work will all be treated.

The conference will open Thursday afternoon, Aug. 2, with flag-raising exercises and an address by C. L. Collens. In the evening F. W. Freeman, president Society for Electrical Development, will speak; J. E. North will report for the League Council, and W. E. Sprackling for the Electrical Industry Sales Conference.

On Friday morning, when promotion of wiring business will be the theme, "The Place of the 'Red Seal' in the Program to Adequately Wire the Homes of America" will be discussed by S. A. Dennis, and "The Status of 'Red Seal' Today" by B. Badrian. Conspicuous examples of "red seal" accomplishment will be given by C. C. Monroe of Detroit, E. W. Hane of Chattanooga, E. J. Beil of Youngstown and a representative of the California Electrical Bureau. On Friday evening Mr. North will tell about "The Plan for Further Broadening the Electrical Market," and other topics will be adequately presented. The promotion of lighting business will be the topic for Saturday. In the evening "The Buying Habits of the Electricity-Using Public" will be examined by Dr. Paul T. Cherington and "The Future of Associations as a Useful Instrument" will be discussed by Hugh P. Baker, manager trade association department, United States Chamber of Commerce.

Sunday will be given over to rest and recreation with an address after supper by a speaker of national prominence. Monday the promotion of appliance business will be on the carpet. "Intertrade Merchandising Problems" will be looked into by C. E. Greenwood, commercial director N.E.L.A. There will be an open forum for the discussion of league problems in the evening. Promotion of industrial business will take up Tuesday morning, Aug. 7.

Briefer News

INTERSTATE LINE FROM SHREVEPORT TO MARSHALL BEGUN. — Construction of a 66,000-volt transmission line from Shreveport, La., to Marshall, Tex., about 25 miles, by way of Trees City, La., and Jefferson, Tex., is starting. The line will be erected for the Southwestern Gas & Electric Company, which supplies power for most of the towns and cities in that area.

MCGRAW-HILL PUBLISHING COMPANY ANNOUNCES "FOOD INDUSTRIES." —The McGraw-Hill Publishing Company announces that, starting in October, it will publish a monthly to be known as *Food Industries*. The new publication will be for men interested in the manufacturing and processing of foods. Its editorial direction will be under Dr. H. C. Parmelee, editor of *Chemical and Metallurgical Engineering*.

BOSTON LEAGUE HAS SERVICE CONNECTION COMMITTEE.—A service connection committee of executive officers has been formed by the Metropolitan Electrical League of Boston for a discussion of the advantages of uniformity of thought about central-station service requirements. A sub-committee will analyze service requirements of the Boston, Cambridge and Malden central-station companies. When this analysis shall have been completed the companies will, it is thought, be in a position to co-ordinate their requirements by agreement between themselves and in line with suggestions from other groups.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see ELECTRICAL WORLD for Jan. 7, page 80.]

Michigan Section, N.E.L.A.—Mackinac Island, July 5-7. Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

Public Utilities Advertising Association—Detroit, July 8-12. T. P. Pfeiffer, Byllesby Engineering & Management Corp., Chicago.

East Central Division, N.E.L.A.—Cedar Point, Ohio, July 10-13. D. L. Gaskill, Greenville, Ohio.

National Electric Credit Association—Boston, July 16 and 17. F. P. Vose, 1008 Marquette Bldg., Chicago.

Wisconsin Utilities Association, Electric Section—Appleton, Wis., July 26 and 27. J. N. Cadby, 432 Broadway, Milwaukee.

National Electrical Manufacturers' Association — Policies Division, Association Island, Henderson Harbor, N. Y., July 29-Aug. 1. S. N. Clarkson, 420 Lexington Avenue, New York.

Camp Co-operation VIII—Association Island, Henderson Harbor, N. Y., Aug. 2-7. Society for Electrical Development, 420 Lexington Avenue, New York.

Association of Electragists International—Hotel Stevens, Chicago, Aug. 6-11. L. W. Davis, 15 West 37th St., New York.

American Institute of Electrical Engineers — Pacific Coast convention, Spokane, Wash., Aug. 28-31. F. L. Hutchinson, 33 West 39th St., New York.

The action taken is almost sure to attract interested consideration throughout New England central-station circles.

WISCONSIN LEGISLATURE COMMITTEE INSPECTS ONTARIO HYDRO.—A special committee appointed by the Wisconsin Legislature has been touring the Province of Ontario making a detailed inspection of hydro-electric service in representative rural communities and in towns and cities, with a view of making recommendations for further utilization of Wisconsin's water-power resources. The party is under the direction of John Purcell, who is in charge of rural extension work in Wisconsin.

ILLUMINATION PROBLEMS STUDIED BY SPECIAL CLASS AT NELA PARK.—The course on problems of modern illumination given from June 11 to 16 by the Nela School of Lighting of the National Lamp Works in Cleveland was well attended. Thirty-seven members were registered, several from across the seas, and the remainder consisting of central-station men, college instructors and men closely associated with the business of lighting. Takeshi Hirohashi of Tokyo, Japan, received honorable mention in the final examinations.

SEATTLE TO HOUSE CITY LIGHTING DEPARTMENT IN NEW SUBSTATION.—The Seattle City Council has appropriated $991,500 to cover the cost of a substation and lighting department office building and equipment. Tentative plans provide for a structure with two stories and two basements at Third Avenue and Madison Street. This building will cost $200,000, the site the same amount, and the remainder will be spent in equipment.

CROSSING THE RED RIVER FROM TEXAS TO OKLAHOMA.—The recently energized 66,000-volt transmission line which links the West Texas Utilities Company's system at Vernon, Tex., with that of the Southwestern Light & Power Company at Frederick, Okla., crosses the Red River by means of a span which is 2,223 ft. in length between rest frames and 3,316 ft. between dead ends. It is carried on steel towers high over the stream that here forms the interstate boundary.

BILL INTRODUCED TO PERMIT NEW ORLEANS TO BUY PUBLIC SERVICE PROPERTIES.—Measures have been reported favorably to the Louisiana Senate which prescribe methods of finance that will enable the city of New Orleans to exercise its legal authority to purchase properties of the New Orleans Public Service, Inc. The bills authorize the city, after approval by a vote of the people of New Orleans, to issue 50-year bonds, to be secured by the properties purchased and the income derived from them. The city government also is empowered to sell or lease the properties to third parties. These bills, it was explained, are for the purpose of permitting the city to distribute natural gas in New Orleans in the event other

arrangements are not made. The New Orleans Public Service, Inc., owns also the light and power system of city.

DETROIT'S NEW "WHITE WAY."—Detroit is getting ready to boast one of the most brilliantly lighted thoroughfares in the world after July 10, when current will be sent into the "white-way" system on Washington Boulevard. Plans for the event include the attendance of city officials, members of the International Advertising Association, which will be in convention there, and men prominent in the city's business life.

POWER PLANT STACK TO GUIDE AVIATORS.—A move to co-operate with the government in directing aviators at night is reported from Colorado. The smokestack of the Pueblo plant of the Southern Colorado Power Company is 250 ft. high and 14 ft. in diameter at the base. The stack is to be lighted by eight 500-watt floodlamps placed in pairs at the base of the stack. When lighted they will cause the stack to appear as a huge illuminated cylinder.

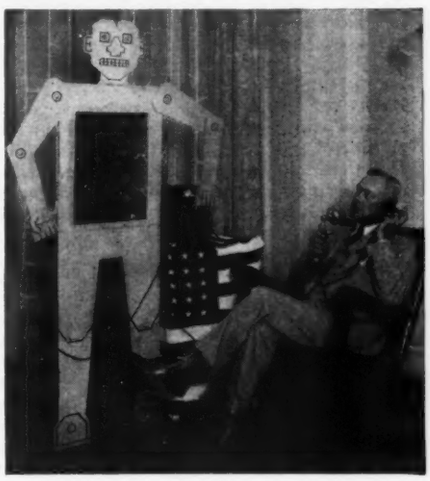
PACIFIC GAS & ELECTRIC WILL SUPPLY ENERGY TO 43 AIRWAY BEACONS.—Contract to supply electrical energy for the lighting of 43 airway beacons in California has been awarded to the Pacific Gas & Electric Company by the United States government. The contract includes 85 miles of the San Francisco-Los Angeles route, 185 miles of the San Francisco-Seattle route and 135 miles of the San Francisco-Salt Lake route, or a total of more than 400 miles. The beacons will be approximately 10 miles apart.

BROOKLYN EDISON COMPANY'S PROHIBITION OF SUBMETERING CHALLENGED.—Steps which were taken by the Brooklyn Edison Company to prevent the spread of the practice of electric submetering from Manhattan Borough, where it is widespread, to Brooklyn, where it had obtained a relatively small foothold, by means of an amendment to the company's rules filed with the New York Public Service Commission, have been challenged by the Survel Realty Corporation, owner of a large new apartment building, and a hearing on the company's rule, which has been in operation since Feb. 5 and which probibits service through a master meter for submetering, will be held.

DIX RIVER PLANT BREAKS RECORD.—All generating records of the Kentucky Hydro-Electric Company, operating the Dix River plant, were broken on June 13, when over a twenty-four-hour period the plant produced 512,000 kw.-hr., operating steadily at 94.9 per cent of generating capacity. A still higher record could probably have been made if there had been an outlet for additional energy. On June 12 the output was 486,000 kw.-hr. The previous record had been made on Jan. 1, 1927, and was 453,000 kw.-hr. Heavy rains made the new figures possible, there being 244.7 ft. of water behind the dam and 2.7 ft. of water breaking over the spillway. The company says the output recorded is in excess of the anticipated capacity of the plant.

COLUMBUS' NEW "WHITE WAY."—"White way" boulevard lights are being installed in the driving park on Livingston Avenue, Columbus, Ohio. Approximately 17,000 ft. of cable and 64 light standards will be used to light Kelton, Lilley, Berkeley and Geers Avenues in the park, according to the superintendent of the municipal light plant. The new lamps are of the lantern type, 13 ft. above the street, with 400-cp. bulbs. The are spaced 200 ft. apart on alternate sides of the streets.

"TELEVOX" A POPULAR MAN AT ELECTRICAL CONVENTIONS.—At a number of recent electrical conventions a popular attendant has been "Televox," the electrical man built by R. J. Wensley of the Westinghouse Electric & Manufacturing Company to demonstrate his televocal system for the automatic operation of machinery by sound. This system was described in the ELECTRICAL WORLD, for Oct. 15, 1927 (page 803). The picture shows W. L. Frost, general commercial manager Southern California Edison Company and retiring president Pacific Coast Electrical Association, giving orders to "Televox" at the recent Pasadena convention of that association.



DEDICATION OF NORWOOD PLANT IN NORTH CAROLINA.—Seven hundred people, representing 191 communities, attended a barbecue given by the Carolina Power & Light Company near Mount Gilead to mark the opening of the Norwood hydro-electric power plant. This new station, situated on the Pee Dee River in Montgomery County, about four miles from Mount Gilead, has a concrete spillway dam 1,553 ft. long combined with an earth dam 1,258 ft. long with a maximum height of 100 ft. The reservoir is 18 miles long with a maximum width of three-fourths of a mile and covers 6,500 acres. The power house is built into the downstream face of the dam on the east side of the river. The generating equipment consists of one 24,000-hp. and two 29,000-hp. vertical generators, directly connected to waterwheels, making the total capacity of the plant approximately 82,000-hp. Provision has been made for the installation of a fourth unit. The generators are outside the power house and are protected by steel covers. The operating head on the wheel is 72 ft.

SPRINGFIELD, MASS., AND TURNERS FALLS COMPANY SIGN CONTRACT.—The Springfield (Mass.) Water Commission and the Turners Falls Power & Electric Company have signed the contract by which the company is to purchase from the city electrical energy generated in a plant to be built in connection with the Cobble Mountain reservoir and dam. The next move is to obtain the approval of the Massachusetts Public Utilities Commission, which is asked to set an early date for a hearing. The company is to take a 30-year lease of the plant, with payments of $270,000 annually, and turn the plant back to the city in a satisfactory condition at the expiration of that term.

EXPERIMENT IN PARALLEL OPERATION BETWEEN KEOKUK AND BOSTON.—The area of previous experiments in long-distance parallel operation was extended recently during a four-hour test of the Joliet-Kewanee line of the Illinois Power & Light Corporation. When the test began power from Keokuk to Kewanee was cut at Galesburg and Chicago station power was cut into the Kewanee loop. Immediately thereafter Keokuk was cut into the Chicago wire, St. Louis was added to the circuit, and then parallel operation all the way to Boston was effected through Chicago. It was reported to be the first time that direct connection had been established between Chicago and St. Louis.

"WORLD'S LARGEST" COOLING TOWER FOR BIRMINGHAM, ENGLAND.—A reinforced-concrete cooling tower which is now being erected in connection with the Hams Hall generating station at Birmingham, England, will, its designers say, take precedence as the biggest in the world. It is to rise to a height of 220 ft. and will have a diameter of 168 ft. at the base. It is the first of two towers each capable of cooling the circulating water required for a 30,000-kw. turbine. The foundations of the station are nearing completion, and an electrically operated overhead crane with a lifting capacity of more than 150 tons is ready to install the first large alternator. The cost of the first unit of this plant is estimated at approximately $7,500,000.

NEW JERSEY POWER & LIGHT AWARDS CONTRACT FOR 50,000-KW. TURBINE.—The New Jersey Power & Light Company, subsidiary of the General Gas & Electric Corporation, has awarded to the General Electric Company a contract for a 50,000-kw. turbine to be installed in the new steam generating station of the power company at Holland, N. J., on the Delaware River and

operated at 1,200 lb. pressure. Construction work on this plant, which is to represent an investment of approximately $5,000,000, is now actively under way, and it is planned that this new generating unit of the Pennsylvania-New Jersey power system shall be ready for operation early in 1929. The station will be tied in with the Metropolitan Edison system, another General Gas & Electric subsidiary.

TEXAS CITY'S COMING POWER PLANT.—The new steam power plant of the Texas-Louisiana Power Company at Texas City, Tex., will be completed soon at a cost of $300,000. The first unit will be placed in operation early in July. Transmission lines are being constructed from the plant to La Marque and a number of other towns in the Gulf Coast region. The plant also will furnish power and light for Texas City itself.

EASTERN SHORE GENERATING PLANT IN FULL OPERATION.—The million-dollar 12,000-kw. generating plant at Vienna, Md., now owned by the Insull interests and operated by the Eastern Shore Public Service Company of Salisbury, Md., is now virtually in full operation, that company reports, and serves 17,000 customers over 294 miles of transmission lines and 315 miles of distribution lines. It is the largest generating plant on the tri-state peninsula made up of Delaware and parts of Maryland and Virginia and sometimes distinguished as "Delmarva."

RURAL RATE REDUCTIONS ON SAN JOAQUIN SYSTEM.—Reductions in rates for agricultural power on the system of the San Joaquin Light & Power Corporation in Merced, Mariposa, Madera, Fresno, Tulare, Kings and Kern Counties, which will result in an estimated saving of $250,000 a year, have been ordered by the California State Railroad Commission. The new rate schedule will become effective April 1, 1929. It resulted from informal negotiations conducted between representatives of the corporation and the California Farm Bureau Federation.

KANSAS COMMISSION REFUSES TO ORDER RATE REDUCTION FOR WICHITA.—Present rate schedules of the Kansas Gas & Electric Company for Wichita will continue in force, the Kansas Public Service Commission has decided. The city of Wichita sought to compel the company to lower its charges, on the ground that Wichita, the largest city on the system, enjoys no advantage over smaller towns in the matter of rates and that a city of approximately 100,000 population shrould pay less for its electricity than places having a population of only a few hundred.

MID-HUDSON REGION OF NEW YORK GETS ANOTHER RATE DECREASE.—The Central Hudson Gas & Electric Corporation of Poughkeepsie, N. Y., has announced another reduction in its rates for all classes of electrical customers, to become effective on bills rendered on and after July 15. The reduction represents a total net annual saving to customers in the territory served of $75,000. This is the second rate reduction since the consolidation on Jan. 1, 1927, of the separate companies which formerly operated in the central Hudson region and the fifth rate reduction since 1924.

Commission Rulings

NEW JERSEY COMMISSION REFUSES JURISDICTION OVER CONTRACT FOR SPECIAL INDUSTRIAL SERVICE.—A contract between E. I. Dupont de Nemours & Company and the Atlantic City Electric Company by which the latter agreed to construct an additional line of poles to serve the former, which in turn was bound to take service for a number of years at a compensation sufficient to amortize the capital expenditure, was not passed upon by the New Jersey Board of Public Utility Commissioners, which found that it came within the class of contracts for special service between public utilities and certain consumers that do not require the approval of the board. The fact that happenings at some future time might bring the matter within the board's jurisdiction could not be anticipated, since they might never arise.

COMPANY NOT TO BLAME FOR UNSATISFACTORY SERVICE TO DIRECT-CURRENT ELEVATOR.—Complaint against inadequate electric service furnished by the Grays Harbor Railway & Light Company in Aberdeen, Wash., was made by a customer who alleged that to this was due difficulty in operating the elevators in his five-story building. It was determined that 370 volts potential was required to hold the brakes on the elevator in a released position, and that if the voltage was less, the brakes would not release and the elevator could not be operated without great inconvenience to the tenants. Voltage at the power house was between 595 and 600, but when traffic was heavy the voltage was frequently reduced below 370. The Department of Public Works dismissed the complaint, pointing out that the elevator was installed in the year 1910 at a time when alternating-current elevators had not been perfected and that the company did not then furnish and had not since furnished direct-current service from a commercial line. Service furnished to the elevator was declared to be as good as it ever was. It appeared that one of two things was necessary to give satisfactory elevator service—either to install alternating-current equipment or to build a line direct to the power house. The department was unable to find any reason why the public utility company should bear any portion of the cost of either.

METERING ENERGY TO RURAL CUSTOMER OWNING HER TRANSMISSION LINE.—In denying an application by the Iron River Water, Light & Telephone Company to increase its rural electric rates to a single customer owning her own transmission line, an unusually long one, the Wisconsin Railroad Commission ordered an adjustment of the method of metering previously followed on the line, of which it said it had no authority to authorize the company to assume ownership, and the frequent and unexplainable necessity for meter repairs on which constituted, it asserted, a burden from which the special-contract consumer was entitled to relief. The commission held the most satisfactory solution of the metering problem to be the installation of two meters on the secondary side of the transformers, one for lighting circuits and the other for motors, in view of the fact that such meters are less expensive than primary metering equipment and also because of the protection from lightning or other voltage disturbances. The objection that such local meters would not record transformer losses was held illogical where the primary metering of the type employed did not register more than a small fraction of such losses. The core loss could be accurately estimated, the commission said. Moreover, the core loss and copper losses were more than offset by the value to the company of that portion of the extension used in the service of other customers.

Recent Court Decisions

BOROUGH WHICH ALLOWED WIRE IN PARK TO SAG WITHIN REACH OF CHILDREN NEGLIGENT.—In Novak vs. Borough of Ford City, a suit for damages because of injury to an eight-year-old boy who seized a sagging wire conveying electricity for lighting purposes to a monument in a park, the trial court found for the plaintiff, and the Supreme Court of Pennsylvania has confirmed the finding. The vertical distance of the wire at the time of the accident from a small mound on which children were accustomed to play was estimated by different witnesses at from 4 ft. to 6½ ft. It was maintained by the defendant that the boy jumped and caught hold of the wire and had climbed on the monument base with that purpose. These actions, if performed, were natural on the part of a child and to be anticipated, the court said, and, though there was no proof of actual notice to the borough that the wire was sagging, there was ample proof of constructive notice, the same condition having been complained of as far back as the preceding summer. (141 At. 496.)*

VESTED RIGHTS, PRIVILEGES AND FRANCHISES CANNOT BE IMPAIRED BY ORDINANCE.—Declaring void an ordinance of the Borough of Montvale regulating the erection and maintenance of poles, wires and accessories for the transmission of energy, the Supreme Court of New Jersey has declared in a suit brought against the borough by the Rockland Electric Company that "where a borough ordinance has given to an electric light company permission to erect upon the streets and public places in the borough poles and appliances for the carrying and transmission of electrical current, the streets and public places have been designated for such purpose in such ordinance, and the company has expended money in the prosecution of its business in reliance upon said ordinance, the rights, privileges and franchises granted thereby are vested and cannot be repealed or impaired by the passage by the borough council of an ordinance requiring the obtaining of a new consent from the mayor and borough council." (141 At. 673.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

News About Men of the Industry

P. S. Gregory New President of Canadian Association

P. S. Gregory, assistant to the vice-president and general manager of the Shawinigan Water & Power Company, has been elected president of the Canadian Electrical Association for the coming year. He has been in the utility business since 1912, starting first in the traction field and entering the electric light and power field in 1918. At that time he became electrical engineer of the Shawinigan subsidiary distribution companies, later (1922) growing into his present executive position, where negotiation of large power contracts constitutes a major function. Mr. Gregory

P. S. Gregory

was graduated from Bishops University and McGill University with B.A. and B.Sc. degrees respectively. He has been on the executive committee of the Montreal branch of the Engineering Institute of Canada, chairman of the meter and power sales bureaus of the Canadian Electrical Association and a member of the Electric Club of Montreal.

GEORGE CLINTON WARD, executive vice-president of the Southern California Edison Company, was awarded the honorary degree of doctor of science at Oberlin College on June 19 in recognition of his work in applying the results of scientific research to the field of electrical and mechanical engineering.

GEORGE KIDD, for many years president of the British Columbia Electric Railway Company, Ltd., Vancouver, has been made president of the British Columbia Power Corporation, which now controls the former company and all its subsidiaries. W. G. Murrin, for a long period vice-president of the British Columbia company, has become vice-president of the British Columbia Power Corporation and A. T. B. Goward will continue to occupy a similar position with headquarters in Victoria. Sir Frank Barnard and Blake Wilson are members of the board of directors. Mr. Kidd, who recently returned to Vancouver from eastern Canada, where he attended a conference of the new owners of the company, stated that he had been assured that the past policy and management of the electric railway company would be continued and that there was not the slightest intention on the part of the new owners of interfering in any way with the rates or affairs of the company as they have been conducted for many years.

ROBERT A. MILLIKAN, director of the Norman Bridge Laboratory of Physics of the California Institute of Technology, was awarded the honorary degree of doctor of science by Princeton University at the recent commencement exercises. Dr. Millikan won this recognition as a result of his scientific studies on the electron. The citation read: "In the history of modern physics his work will always have a conspicuous place."

GEORGE M. GADSBY, president of the West Penn Power Company, was made the recipient of the honorary degree of doctor of engineering by the University of Pittsburgh at the recent commencement exercises. The interest of Mr. Gadsby in the promotion and development of educational programs within and without his company and in developing educational opportunities for those within his company's employ was cited by Dean Holbrook of the university as one of the reasons for the awarding of the degree. Mr. Gadsby is a graduate of Marietta College and of the Massachusetts Institute of Technology. He received his master of arts degree at Marietta College and this month was elected a member of its board of trustees.

STUART M. COOPER, president of the South Carolina Power Company, has resigned after an association with the Charleston utilities of nine years to affiliate himself with the United Gas Improvement Company, Philadelphia. The U.G.I. organization owned the public service company in Charleston until 1926, when the Charleston Consolidated Railway & Lighting Company was bought by the Southeastern Power & Light Company. Prior to removing to the South Mr. Cooper had been connected with the United Gas Improvement Company since 1907. A graduate of Syracuse University in electrical engineering, he served as assistant engineer of the Syracuse Lighting Company, subsequently entering the employ of the New York & Queens Electric Light & Power Company. After a period of three years he was transferred to the Counties Gas & Electric Company, Norristown, Pa., subsequently removing his interests to the main office of the United Gas Improvement Company. In 1919 he became general manager of the Charleston company, later vice-president and two years ago president.

Luke Bradley Resigns

Luke C. Bradley, president of the Rhode Island Public Service Company, which some time ago took over the United Electric Railways and the Narragansett Electric Lighting Company, announced on June 23 that he will submit his resignation to the directors of the company at their July meeting. The resignation is to become effective Aug. 1. He will assume an executive position with the Electric Bond & Share Company, New York.

Early in February, 1927, Mr. Bradley was elected president of the service company, to succeed Louis C. Gerry. Mr. Bradley resigned a similar position

L. C. Bradley

with the Virginia Electric & Power Company to accept the Providence offer. Associated with Stone & Webster, Inc., of Boston, in executive positions for 22 years, Mr. Bradley had varied experience as directing head of utility companies in different parts of the country. As president of the Virginia company he had direct supervision over electric light and power properties, street railways, bus systems and gas properties extending over 40 cities in Virginia and North Carolina. He was also executive vice-president and division manager of utility properties under the management of Stone & Webster in the Southwest and is recognized as one of the most successful executives in the public utility field.

It is reported that Frank D. Comerford, president of the New England Power Association, will succeed Mr. Bradley as president of the Rhode Island Public Service Company.

E. P. PECK, whose resignation as vice-president of the Utica (N. Y.) Gas & Electric Company, was announced in the April 21 issue of the ELECTRICAL WORLD, has been appointed to the position of engineer of special studies for the New York Power & Light Corporation with offices in Albany. During his association with the

Utica utility, which dated back to 1919, he was responsible for the engineering of the extensive transmission and distribution lines at Utica, New Hartford and Deerfield and the building of those at Ilion, Little Falls and Dolgeville.

E. Donald Tolles Directs Wholesalers' Association

E. Donald Tolles, who was elected managing director of the National Electrical Wholesalers' Association at the recent convention held in Hot Springs, Va., as announced in the June 9 issue of the ELECTRICAL WORLD, brings to his new executive position a broad background of experience in association

E. D. Tolles

work. After a business career covering a period of ten years, he became associated in managing a number of societies and trade associations with Franz Neilson, whom he succeeded as secretary of the New York Electrical Credit Association in 1920. Mr. Tolles first became identified with the Electrical Supply Jobbers' Association, forerunner of the National Electrical Wholesalers' Association, in 1917, as secretary of its Atlantic Division and four years later he was appointed its national representative, in this position acquainting himself with a large number of both manufacturers and jobbers throughout the United States. He more recently served as executive secretary of the association before assuming the duties of managing director.

Mr. Tolles is a native of Attice, N. Y. During the war he was active in Washington in the interests of the industry, devoting particular attention to the cause of the jobbers.

WALTER G. JENS has been appointed manager of the Pittsburgh branch of the Byllesby Engineering & Management Corporation, having formerly served as general superintendent of that corporation. Mr. Jens went to Pittsburgh in 1926 from Minneapolis, where he had been in charge of construction work for the Northern States Power Company for about ten years prior to that time. When the Pittsburgh branch of the Byllesby corporation was organized on Jan. 1, 1927, Mr. Jens was general superintendent of construction and in December of that year was made acting manager. His appointment as manager was made the occasion of a dinner in his honor on June 18, at which M. R. Sumner, general superintendent of construction, reviewed Mr. Jens' work and paid tribute to his executive leadership.

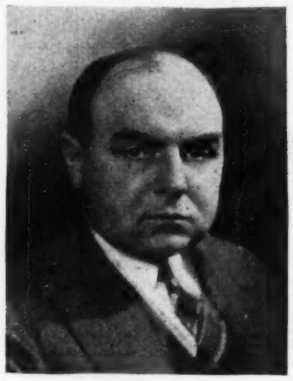
MAURICE A. OUDIN, vice-president of the International General Electric Company, Inc., who has just returned from a trip to Europe, was decorated with the order of Commander of the Crown of Italy.

JAMES G. HARBORD, president of the Radio Corporation of America, was awarded the honorary degree of doctor of laws by Yale University at the recent commencement exercises held in the Woolsey Hall Auditorium at New Haven.

T. A. Kenney Elected to New Executive Position

T. A. Kenney, who recently became a director of the Commonwealth Power Corporation, has been elected a vice-president and director of the Allied Power & Light Corporation, which was formed recently to consolidate the interests of Hodenpyl, Hardy & Company, Inc., and Stevens & Wood, Inc. Mr. Kenney at an early age entered the employ of the Hudson River Power Transmission Company, which subsequently became a part of the Adirondack Water Power Corporation. This early association, which afforded first-hand experience with the electrical industry, included not only high-voltage power transmission but local electric distribution, industrial power application and electric railway operation as well. In 1912 Mr. Kenney joined the Hodenpyl, Hardy organization in the capacity of manager of the production and transmission department of the Consumers Power Company with headquarters at Jackson, Mich. That company was then consolidating a great many widely scattered hydro-electric companies in the state and interconnecting them, all of which required further pioneering work. Four years later he came to New York as assistant to B. C. Cobb in charge of operations of the Hodenpyl, Hardy properties which comprise one of the largest public utility groups in the United States.

In addition to his executive duties, Mr. Kenney has been prominently identified with the National Electric Light Association and the American Electric Railway Association activities. He is at present a member of the public



T. A. Kenney

policy committee of the National Electric Light Association, and in addition to being a member of the executive committee of the American Electric Railway Association is chairman of the finance committee of that organization. In addition to his duties with the Commonwealth Power Corporation and the Allied Power & Light Corporation Mr. Kenney is vice-president and a director of a number of other utility companies.

Obituary

WILLIAM LUND, a pioneer inventor in the electrical field, died at Hull, Mass., June 19, at the age of 87. Mr. Lund was a native of Bradford, England, and retired from business in Philadelphia ten years ago.

WALTER CLAUDE JOHNSON, who was associated with the electrical industry in Great Britain in its early days, died June 2 near London in his eightieth year. Following an engineering apprenticeship, Mr. Johnson received an appointment with the Telegraph Construction & Maintenance Company, in which position he obtained experience in the laying of submarine cables and the manufacture of machinery for that purpose. In 1876, in conjunction with S. E. Phillips, he founded the business of Johnson & Phillips, Ltd., Charlton, England. Following the introduction of electric lighting, the partners engaged in the production of generators and arc lamps, and subsequently undertook the manufacture of insulated wires and cables.

CHARLES A. HARBER, long identified with the electrical industry in Kansas City, Mo., died at his home in Fairmount, Mo., after a long illness. Mr. Harber was general superintendent of the Kansas City Power & Light Company for 27 years, having retired in 1910. He was 68 years of age.

THOMAS S. MARLOWE, who directed the installation of the electric light plant at Holden, Mass., died June 12 at his home in that town. Mr. Marlowe was superintendent of the Holden plant for 35 years and was a native of Underhill, Vt., where he was born 62 years ago.

Financial and Statistical News

Missouri Utility Makes New Offering

During the past week the Missouri Power & Light Company issued first mortgage 4½ per cent gold bonds, series B, to the amount of $1,500,000, the price being 92¼ and accrued interest, to yield 5 per cent. These securities, dated May 1, 1928, and maturing May 1, 1958, will constitute a direct obligation of the company and will be secured by a first mortgage on the entire fixed property of the company now owned or to be hereafter acquired, subject, however, to underlying mortgage liens, if any, on future acquisitions by the company. The proceeds from the sale of this issue of bonds will be used to reimburse the company for property additions, expenditures for which have been or are to be made.

Commonwealth Power Pays Larger Common Dividend

The directors of the Commonwealth Power Corporation have declared a quarterly dividend of 75 cents per share on the common stock, payable Aug. 1 to holders of record July 12. From Aug. 1, 1927, to May 1, 1928, inclusive, quarterly dividends of 62½ cents per share were paid on this issue, and in addition the company on May 1 last paid an extra dividend of 50 cents per share. R. P. Stevens was elected vice-president and director and also a member of the executive committee and T. A. Kenney and H. S. Scarritt were elected members of the board, succeeding Earl S. Colman, W. M. Flook and Waldo S. Reed.

New French Holding Company Formed

Formation of a new holding company, organized by American and French interests for the purpose of taking an active part in the development of the electrical industry in Europe through the acquisition of stocks, was announced during the past week. The company, which will be known as Compagnie Franco-Americaine pour l'Electricité et l'Industrie, will have a capitalization of 50,000,000 francs. The group interested in the formation of the company consists of Blair & Company, Inc., l'Union des Mines, Banque Compagnie Générale d'Electricité, l'Union Houillère Electrique.

CENTRAL PUBLIC SERVICE TO READJUST STRUCTURE.—At a general meeting to be held July 9 directors of the Central Public Service Corporation will propose to the stockholders a number of amendments which will result in a comprehensive plan for the readjustment of the financial structure. It is proposed to give the class A stock priority over the common stock to the extent of $1.75 a share per annum in earnings and $30 a share in liquidation. In addition the class A stock will participate equally with the common in earnings and surplus in liquidation after the common stock has received an amount equivalent to the class A priority. At the present time the class A stock is limited to a maximum of $2.50 a share per annum in dividends and to a maximum of $25 a share in liquidation, in priority to the common stock. This readjustment of the company's financial structure will enable the organization to exercise greater flexibility and economy in taking care of future requirements for growth and expansion.

JERSEY COURT ENJOINS FINANCE COMPANY.—An injunction has been granted by Vice-Chancellor Berry to the Public Service Corporation of New Jersey restraining the Public Service Finance Corporation of Newark from using the words "Public Service" as part of its title. At the hearing affidavits were filed to show that the Public Service Finance Corporation, which was incorporated to do a personal loan business, was not connected financially or otherwise with the Public Service Corporation or with any of its subsidiaries.

German Utility Company Floats New Loan

The East Prussian Power Company made an offering of first mortgage sinking fund gold bonds, amounting to $3,500,000, at 91 and interest, yielding 6.75 per cent. These securities, dated June 1, 1928, mature June 1, 1953. They will be secured by a direct first mortgage, ranking equally with an existing mortgage securing approximately $553,572 5 per cent internal bonds, on substantially all the fixed properties of the company.

Public Service Corporation in Economical Operating Position

IN SHARP contrast to the situation in the case of some of the larger utility systems with properties scattered to the four corners of the country, the Public Service Corporation of New Jersey has its assets of over $615,000,000 segregated within a compact area between New York and Philadelphia. The system has reached its present prominent position among the nation's twelve leading utility groups by natural growth, over the past two decades, rather than by the purchase of any important new properties.

Public Service Corporation's common stock has yielded large returns, but more moderate than in the case of some of the other holding company issues. The average price of the stock during 1923 was $46. After a three-for-one split a current price of the stock, on the original basis, would be around $160. Common dividends have been paid uninterruptedly since 1907. On the original $100 par stock a dividend of $4 was paid in 1920 and 1921. This was steadily increased to an $8 rate in 1923, when shares were split two-for-one. On the new stock $5 was being paid until 1926, when the three-for-one split referred to was effected. Thus the current rate of $2 is equivalent to $12 on the original shares. Furthermore, from 1924 to 1926 the corporation gave five allotments of common stock for subscription, and in November last and January of this year shareholders were offered rights for 6 per cent preferred stock and 4½ per cent debentures with a combined maximum per share worth of 96 cents.

After dividends, surplus earnings have been consistently turned back into the improvement of properties and equipment. Refunding of bonds at lower interest rates during recent months has made possible a saving of more than 20 cents per common share annually. Furthermore, appropriations of 19 per cent of gross revenues for maintenance, depreciation and retirement expenses are larger than in the case of most similarly situated companies. The operating ratio for the system as of Dec. 31, not including maintenance charges, was 42.6 per cent. Fixed capital of the system amounted to $4.47 per dollar of gross.

The Public Service Corporation has followed the customer-ownership policy with marked success. At the end of last year there were 89,769 accounts on the stock ledgers, against 67,303 the year before. In addition there were 18,912 open accounts with subscribers.

Capitalization is represented by $29,079,000 guaranteed stocks of leased companies, $108,613,000 6 per cent preferred stock, including that of the operating gas and electric subsidiary; $28,908,000 7 per cent and $21,531,000 8 per cent preferred stock, as well as 4,153,613 shares of no-par common stock. The funded debt at a recent date totaled $289,460,000.

Record Hydro Output

The production of electrical energy by the use of water power in April established three records, the United States Geological Survey points out. More electricity was produced in a month than ever before, 29,400,000,000

kw.-hr.; the average daily rate of production of electricity by water was also the largest, 98,000,000 kw.-hr., and the proportion of the total output produced by water power was the largest of record, 43 per cent. More than 2,700,000 tons of coal would have been required to generate the electricity produced by water power in April. These totals apply to all energy generated in public utility plants, including those for electric railway and other plants as well as those for light and power. The former, however, constitute only a small fraction of the total. Corresponding data for central-station output were published in the résumé of operations of the industry in the ELECTRICAL WORLD of June 23, 1928.

EMPIRE POWER RESUMES DIVIDEND.—The directors have declared a dividend of 50 cents per share on the participating stock, payable July 1 to holders of record June 21. Quarterly dividends at this rate were paid from October, 1926, to October, 1927, inclusive, but none has been paid since that date.

RECENT LISTINGS.—The New York Stock Exchange has authorized the listing of $1,003,000 additional 30-year first lien stamped 5 per cent sinking fund gold bonds of the Federal Light & Traction Company, due March 1, 1942, making the total applied for $3,823,500 in 5 per cent bonds, $3,482,000 stamped 6 per cent bonds and $3,203,500 stamped 5 per cent bonds. There have also been authorized for listing on the New York Exchange 5,251 additional shares of common stock, class A, of the General Gas & Electric Corporation, without par value, on official notice of issuance and payment in full, making the total amount applied for 356,160 shares. Convertible gold debentures of the Public Service Corporation of New Jersey have been authorized for listing on the New York Exchange to the amount of $24,719,500. These securities, bearing interest at the rate of 4½ per cent mature Feb. 1, 1948. The New York Stock Exchange has also authorized the listing of 141,000 additional shares of class A stock of the Utilities Power & Light Corporation (without par value) on official notice of issuance and payment in full, making the total amount applied for 725,000 shares of class A stock.

Ontario Commission Issues Report

The Ontario Hydro-Electric Power Commission reports a net surplus of $1,291,986 for all hydro municipalities for the fiscal year ended Dec. 31, 1927. Total revenue collected by the electrical utilities during that period was $24,583,022. The cost of power was $13,652,712; cost of operation, maintenance and administration, $4,681,466; debenture charges and interest, $3,694,855. Depreciation is set at $1,262,000. The total investment of the commission in power undertakings and hydro-electric railways is $204,372,066, and the investment of the municipalities in distributing systems and other assets is $81,792,678, making in power and hydro-electric undertakings a total investment of $286,164,745. The total revenue derived from this capital investment aggregated $34,056,707 in 1927.

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday June 26	Low 1928	High 1928
ABITIBI PWR. & PAPER, com.			
new—no par	60	57	85
Ala. Pwr., $7 cum. pf.—no par	*m* 114	114	115½
Allis Chalmers Mfg., 6% com.	116½	115½	129½
Aluminum Co. of Amer., com.	142	120	197½
Aluminum Co. of Amer., 6% pf.	*m* 108½	105½	110½
Amer. & Foreign Pwr. 7% pf.—no par	*m* 106½	105½	110
Amer. & Foreign Pwr., com.—no par	34½	22½	38½
Amer. Bosch Magneto, com.—no par	32½	15½	41
Amer. Brown Boveri Elec.†	17½	10½	26½
Amer. Brown Boveri Elec., pf. $7	60	40½	65½
Amer. Gas & Elec., 6% pf.—no par	104½	104½	111
Amer. Gas & Elec., com.†—no par	162½	117½	184
Amer. Lt. & Trac., 6% pf	118	116	120
Amer. Lt. & Trac., new com.	222	170	249
Amer. Pwr. & Lt., 5% pf.	104½	103½	107½
Amer. Pwr. & Lt., com.†—no par	77½	62½	95
Amer. Pub. Serv., 7% pf.	*a* 101	97½	104
Amer. Pub. Serv., com.†	*m* 60	70	75
Amer. Public Utilities, 7% ptc. pf.	*a* 93½	93½	97½
Amer. Public Utilities, 7% pr. pf.	*a* 94	94	103
Amer. Public Utilities, com.	*m* 50	...	...
Amer. States Sec., A	*a* 10	4	13½
Amer. States Sec., B	*a* 12	4½	17½
Amer. Superpower, 6% 1st pf.	*l* 97½	...	...
Amer. Superpower, Class A†—no par	*m* 34½	34½	56
Amer. Superpower, Class B†—no par	*m* 36½	36½	56½
Amer. Wtr. Wks. & Elec., 6% pf.	*m* 100	101½	106
Amer. W. W. & E., com. new—no par	56½	52	70½
Anaconda Copper cap. $3	67½	63½	74½
Appalachian Electric Pwr., 7% pf.	109	108½	110
Arkansas Pwr. & Lt., 7% pf.	106	108	109½
Assoc. Gas & Elec., $3.50—50	52	...	...
Assoc. Gas & Elec., pf.—$6—no par	96	96	98½
Assoc. G. & E., Class A, 10—no par	49½	47	52½
BABCOCK & WILCOX, 7% com.	123½	117½	128
Binghamton L., H. & P., $6 pf.	100	102	109½
Birmingham Elec., pf.—$6—no par	107	104	107
Blackstone Valley G. & E., 6% pf.	*m* 105	106	112
Blackstone Valley Gas & Elec., 10% com.—50	*m* 165	135	170
Blaw-Knox com.†	*t* 101½	91	108
Brazilian Trac., Lt. & Pwr., com., new	*f* 56½	...	...
Broad River Pwr., 7% pf.	102	105	108½
Brooklyn Edison, 8% com.	*m* 240	106½	268½
Buffalo, Niagara & East. Pwr., $1.60 pf.—25	*l* 26½	...	...
Buffalo, Niagara & East. Pwr. com. $1.20—no par	*l* 38½	...	...
CALIFORNIA ELEC. GENERATING, 6% pf.	99	98	101
Carolina Pwr. & Lt., pf.—$7—no par ex. div.	*t* 108	109	111
Central & S. W. Util., $7 pf.—no par	*a* 101	99½	105½
Central & S. W. Util., pr. in. $7 pf.—no par	*a* 106	103½	112
Central Ark. Ry. & Lt., 7% pf.	105	105	107½
Central Ill. Pub. Serv., $6 pf.	*a* 99	97½	100½
Central Ind. Pwr., 7% pf.	*a* 99½	94	101
Central Maine Power, 6% pf.	97	96	98½
Central Maine Power, 7%	110	109	112
Central Pwr. & Lt., 7% pf.	105	104½	114
Central States Elec., 7% pf.	115	104½	121½
Cincinnati Gas & Elec., 5% com.	*g* 100	97½	100½
Cities Service, $6 pf.—no par	*l* 100½	94½	103½
Cities Service, pf. B—no par	*l* 9½	8½	9½
Cities Service, pf. BB—no par	*l* 95	88½	97
Cities Service, com.—20	*l* 66½	54	71½
Cities Service, Bks. Shrs.—10	*l* 33½	26½	35½
Columbia G. & E. com. $5—no par	107	89½	118½
Columbus Elec. & Power, $2 com. no par	*m* 70	66	79½
Columbus Elec. & Pwr., 7%	110	...	...
Columbus Ry., Pwr. & Lt., 7%	104	107	111
Columbus Ry., Pwr. & Lt., 7% pf. B.	105	105	111
Columbus Ry., P. & Lt., com. no par	125	120	125
Commonwealth Edison, 8% com.	*a* 182	165	189
Commonwealth Pwr., 6% pf.	100½	100½	104½
Commonw'th Pwr., $2, com.—no par	75	62½	87½
Conn. Lt. & Pwr., 8% pf.	121	120	123
Conn. Lt. & Pwr., 7% pf.	117	118	121
Cons. Gas of N. Y., pf.	101	100½	105½
Cons. Gas of N. Y., com. $5—no par	143	119½	170
Cons. Gas, Elec. Lt. & Pwr. of Baltimore, 6% pf.	*e* 109½	109½	114½
Cons. Gas, Elec. Lt. & Pwr. of Baltimore, 5% Pf.	*e* 101	100	105
Cons. Gas, Elec. Lt. & Pwr. of Baltimore, com. $3.00—no par	*e* 77	67½	93
Consolidated Power & Lt., 7% pf.	*m* 105	106	109
Consumers Power, 6% pf.	103	105½	106½
Consumers Power, 6.6% pf.	103	106	107
Continental Gas & Elec., 7% pr. pf.	105	106½	108½
Conti. G. & E. com. $4.40—no par	*m* 225	240	265
Crocker Wheeler, com.†	62	...	...
Crocker Wheeler, 7% pf.	96	77	98
DALLAS PWR. & LT., 7% pf.	110	110	111½
Dayton Pwr. & Lt., 6% pf.	108	107	110½
Derby Gas & Elec., 7% pf.	100	96	100½
Detroit Edison, 8% com.	*m* 199	166½	209½
Dubilier Condenser, com.—no par	3½	2½	5½
Duke Pwr., cap.	135	130	145
Duquesne Lt., 5% pf.	*m* 101½	101	116½
EASTERN NEW YORK UTIL., $7 pf.	*m* 110	111	112½
Eastern States Pwr. B	20½	11½	26½
Eastern States Pwr., pf.	*m* 100	98	100½
East. Tex. Elec., 7% pf.	105	106	109
Edison Elec. of Boston, $12 com.	*d* 275½	252	305
El Paso Elec. 7% pf.	*m* 111	110	112½
Elec. Bond & Share, 6% pf.	*l* 108½	108½	111½
Elec. Bd. & Sh. Sec., com. $1—no par	*l* 103	76	127½
Electric Household Util.†	*a* 24	13½	27
Elec. Investors, 6% pf.—no par	99	101	104
Elec. Investors, com.†—no par	63½	40½	79½
Elec. Pwr. & Lt., ctfs. pf.	107½	106½	110½
Elec. Pwr. & Lt., ctfs., com.—no par	35½	28½	45½
Elec. Ry. Securities, com.—no par	6½	...	...
Elec. St. Battery com. $5.25—no par	74½	69	84½
Elmira Wtr., Lt. & R.R., 7% pf.	105	104	115
Empire Pwr., ptc.†	35	27½	39½
Engr. Pub. Serv. $7, pf.—no par	*m* 110½	107	111½
Engr. Pub. Serv., com.—no par	37	33	46½
Eureka Vacuum Cleaner, com. $4—no par	63½	62½	79
FAIRBANKS MORSE, 7% pf.	109½	104	114½
F.-M., com.—$3—no par	39	32½	54
Federal Lt. & Trac., com. $1.40	53	42	56½
Federal Lt. & Trac., $6 pf.—no par	*m* 102½	98	109
Florida Pwr. & Lt., 7% pf.	*m* 103	105	108
Ft. Worth Pwr. & Lt., 7% pf.	*l* 113½	113	114½
GALVESTON-HOUSTON ELEC. 6% pf.	80	75	85
Galveston-Houston Elec., com.	33	31½	42½
General Cable, Cl. A	63½	56	84½
Gen. Elec. $3 com.—no par	146½	124	174½
Gen. Elec., special—6%	11½	11½	11½
Gen. Gas & Elec. (Del.), com. A $1.50 no par	45½	35½	50½
Gen. G. & E. (Del.) pf. A. $8—no par	135	125	144
Gen. G. & E. (Del.) pf. A $7—no par	118	110	120
Gen. G. & E. (Del.) pf. B $7	114	104	117
Gen. Pub. Serv., $7 pf.	98	...	...
Gen. Pub. Serv., com., no par	22½	16½	29
General Public Utilities, $7 pf.	*m* 98	98	103
Ga. Lt., Pwr. & Rys., com.	*m* 58	55	65
Gt. Western Pwr., 70% pf.	*h* 104	...	...
IDAHO PWR., 7% pf.	109	109	111½
Ill. No. Utilities, 6% pf.	*m* 99	96	100
Ill. Pwr. & Lt., 7% pf.	106½	103	107
Indianapolis Pwr. & Lt., 6½% pf.	*m* 104	102	107½
Indianapolis Pwr. & Lt., $7 pf.	101	100	105
Ingersoll Rand com.	*m* 91	90	98
Int. Combus. Engr., com. $2—no par	58½	45½	72½
Int. Combustion Engr., 7% pf.	106	103	109
Int. Util., Class A—$3.50—no par	45½	44½	52
Int. Utilities, Class B—no par	15½	6½	19½
Interstate Pwr., pf.—$7—no par	100	99	105
Interstate Pub. Serv., 7% pf.	100	103	108
Iowa Ry. & Lt., 7% pf.	101	102	103
JERSEY CENTRAL PWR. & LT. CO., 7% pf.	105½	105	107
Johns-Manville, com. *d*—no par	102½	96½	134

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington; *k*Cleveland. *l*Bid price Wednesday, June 27. *m*Bid price Saturday, June 23. *n*Latest quotations available. †Dividend rate variable.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday June 26	Low 1928	High 1928
KANSAS CITY POWER & LIGHT			
pf. $7	m109¼	109	114
Kansas Gas & Elec. 7% pf.	*l*108	107	110
Kelvinator Corp.	14	11¼	22¼
Kentucky Hydro-Elec., 7% pf.	m103	100	105
Kentucky Sec., 6% pf.	95	94	98
Kentucky Sec., 5% com.	150	140	150
Kentucky Utilities, 6% pf.	105	100	105
LACLEDE GAS LT., 10% com.	252	200	260
Lehigh Pwr. Sec., com.—no par	*n* 65	19¼	65
Long Island Ltg., 7% pf.	m109	110¼	112¼
Long Island Ltg., 6% pf.	m104	107	109
Long Island Ltg., com.†—no par	m250	170	250
Los Angeles Gas & Elec., 6% pf.	*h*110	105¼	112¼
Louisville Gas & Elec., cl. A. $1.75	34‡	28	41
MAN. ELEC. SUPPLY, cap. $5—no par	58	50	66‡
Maytag Co., com. 50—no par	19	18¼	22
Memphis P. & L., pf.—$7—no par	110	109	111
Metropolitan Ed., pf.—$6—no par	108	103	109¼
Metropolitan Ed., pf.—$7—no par	108	109	111¼
Metropolitan Ed., com. $5—no par	m170	125	185
Middle West Utilities, 6% pf.	*a* 97‡	93¼	100‡
Middle West Util., 6% pr.lien no par	*a*103	99	108
Middle West Util., com. $7—no par	*a*144	123¼	169
Midland Utilities, pr. ln. 7% pf.	*a* 99‡	99¼	107
Midland Utilities, 7% pf. A	*a*103	103	105¼
Milwaukee Elec. Ry. & Lt., 7% pf.	105	100	106
Milwaukee Elec. Ry. & Lt., 6% pf.	100	98	110
Minn. Pwr. & Lt., 7% pf.	*l*106¼	107	109
Miss. River Pwr., 6% pf.	110	94	112¼
Mohawk Hudson Pwr., 1st pf.—$7—no par	m106	100	110
Mohawk Hudson Pwr., 2d pf.—$7—no par	m104	100	109
Mohawk Hudson Pwr., com.—no par	39‡	29¼	53
Montana Pwr., 5% com.	m145	102¼	175
Montreal Pwr., com.$2—no par	*f*102	...	...
Mountain States Pwr., 7% pf.	m103	97	105
Mountain States Pwr., com.†	18‡	....	....
NASSAU & SUFFOLK LTG., 7% pf.	107	98	110‡
National Carbon, 8% pf.	*a*137	136‡	139‡
National Elec. Pwr., A†	*a* 33‡	27‡	42
National Pwr. & Lt., pf.—7%	109	107‡	111
National Pwr. & Lt., com.†—no par.	33‡	21‡	36‡
National Pub. Serv., 7% pf.	100	99	104
National Pub. Serv., 7% pfc., pf.	*n*114	....	....
National Pub. Serv., A com. $1.60—no par	27‡	22	29‡
National Pub. Serv., B com.—no par	m 30‡	24‡	32‡
Nebraska Pwr., 7% pf.	m108¼	110	111‡
Nevada-Calif. Elec., com.	*n* 50	33‡	50
New Brunswick Pwr., 4% pf.	60	60	70
New Eng. Pub. Serv., pr. ln. pf. $7	110	98‡	110‡
New Eng. Pub. Serv., pf. $7	98	95	108
New Orleans Pub. Serv.—7% pf.	105	106	110
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	102	91	104
N. Y. Central Elec., 7% pf.	105	101	107
New York Power & Light 7% pf.	112	....	....
Niagara Falls Pwr., 7% pf.—25	m 27‡	27‡	29‡
No. Amer., 6% pf.—50	m 54‡	53‡	55‡
No. Amer., com.—10	65‡	58‡	78‡
No. Amer. Edison, $6 pf.—no par	100‡	100	105‡
Northeastern Pwr., com.	26‡	19‡	31
No. N. Y. Utilities, 7% pf.	107	103	109
No. Ohio Pwr., com.—no par	26‡	18	32
Northern Ohio Pwr. & Lt., 6% pf.	100	90	100
No. Ont. Lt.& Pr. 6% pf.	m 98	94	100
No. States Pwr. (Del.), 7% pf.	109	101	110‡
No. States Pwr. (Del.), 8% com.	135‡	123	152
No. Texas Elec., 6% pf.	55	45	70
No. Texas Elec., com.	19	....	....
OHIO BRASS, com. B $4—no par.	*k* 93‡	90‡	100‡
Ohio Brass, 6% pf.	*k*107‡	106	108‡
Ohio Pwr., 6% pf.	108	104	109‡
Ohio Pub. Serv., $6 pf.	104	95	105
Ohio Pub. Serv., 7% pf.	112	107	112
Ohio River Edison, 7% pf.	107	106	109‡
Oklahoma Gas & Elec., 7% pf.	109	106	115‡
PACIFIC GAS & ELEC., 6% pf.	*m* 26‡	23‡	30
Pacific Gas & Elec., 8% new com.	m 47‡	43‡	53‡
Pacific Pwr. & Lt., 7% pf.	*l*109	106	110
Packard Electric	*k* 66‡	47	68‡
Penn Cent. Lt. & Pwr., $5 pf.—no par	*c* 78‡	79‡	82
Penn-Ohio Edison, 6% pf. no par	m 95	78	99
Penn-Ohio Edison, 7% pf.	108	97‡	109
Penn-Ohio Pwr. & Lt., 7% pf.	105	99	112
Penn Pwr. & Lt.—$7—no par ex div.	*l*108‡	109‡	110‡
Penn Wtr. & Pwr., $2.50 com., new	*e* 79	68	90
Phila. Co., 5% pf.-50	48	45‡	48‡
Phila. Co., 6% pf.—50	m 52‡	52	57
Phila. Co., com.—50	m160	145	174‡
Phila. Elec., 8% com.—25	*c* 67	55‡	74‡
Portland Elec. Pwr., 7% pf.	103	100	106
Portland Elec. Pwr., 6% pf.	93	78	96
Portland Elec. Pwr., 6% 2d pf.	83	55	88
Portland Elec. Pwr., com.	43	....	....
Potomac Elec. Power, 6% pf.	*l*111‡	....	....
Pwr. Sec., pf.—no par.	60	50	68
Pwr. Sec., com.—no par	m 13‡	11‡	14‡
Public Serv. of Colorado, 7% pf.	107	....	....
Pub. Serv. of N. J., 6% pf.	109‡	103‡	115
Pub. Serv. of N. J., 7% pf.	126‡	118	129‡
Pub. Serv. of N. J., $2 com.—no par	54‡	41‡	66‡
Pub. Serv. of No. Ill., 6% pf.	*a*119	110	119
P. S. of No. Ill., com. $8—no par	*a*185	159‡	190‡
Pub. Serv. of No. Ill., $8 com.	*a*185	139‡	190
Pub. Serv. of Okla., 7% pr. ln.	109	100	107
Pub. Serv. Elec. & Gas, 6% pf.	107‡	107‡	110‡
Puget Sound Pwr. & Lt., 7% pf.	m110	105	110
Puget Sound Pwr. & Lt., $6 pf.—no par	m100	96‡	105‡
Puget Sound Pwr. & Lt., com.	89	34‡	94‡
RADIO CORP. OF AMER., $3.50 pf.—50	55‡	54‡	60
Radio Corp. of Amer., com.—no par.	175‡	85‡	224
Rochester Gas & Elec. 6% pf. D	105‡	105‡	106‡
Rochester Gas & Elec., 7% pf. B	104	105	108
Rochester Gas & Elec., 6% pf. C	104	105‡	106‡
SAN JOAQUIN Lt. & Pwr., 7% pr. pf.	117	110	117‡
St. Joseph Ry., L., H. & P., 5% pf.	m 75	70	75
Servel, Inc.	m 14‡	4‡	16‡
Shawinigan Water & Power.com.,$2 no par	*f* 92	...	...
Sierra Pacific Elec., 2% com.	38‡	29	40‡
Sioux City Gas & Elec., 7% pf.	105‡	100	108‡
Southeastern Pwr. & Lt., pf.—$7 no par	*l*107	....	....
Southeastern Pwr. & Lt., pfc. pf.	*i* 87	....	....
Southeastern Pwr. & Lt., com.—no par	49‡	40‡	61
So. Calif. Edison, 8% pf.	49	38‡	53
So. Calif. Edison, 7% pf.	29	27‡	29‡
So. Calif. Edison, 6% pf.	27	25‡	28
So. Calif. Edison, 8% com.	45‡	43‡	53‡
Southern Cities Utilities, 7% pf.	83	75	92
Southwestern Lt. & Pwr., A $3	65	60	80
Southwestern Lt. & Pwr., B	50	...	...
Southwestern Lt. & Pwr., $6 pf.	90	88	96‡
Southwestern Pwr. & Lt., 7% pf.	m111‡	103	115
Standard Gas & Elec., 8% pf.	68‡	65	71‡
Standard Gas & Elec., 7% pr. pf.	113	108	115
Standard G. & E., com. $3.50	64‡	57‡	74‡
Standard Power & Light, com.	49	29‡	58‡
Standard Pwr. & Lt., 7% pf.	104‡	103‡	107‡
Staten Island Edison, pf.—$6—no par	97	99	103‡
Superheater, $6 com.—no par	150	...	...
Syracuse Lighting, 7% pf.	110	103	112‡
Syracuse Lighting, 8% pf.	m120	114	121
TAMPA ELEC., com. $2	65	...	...
Tenn. Elec. Pwr., 6% pf.	100	92	103
Tenn. Elec. Pwr., 7% pf.	107	107	110
Tex. Pwr. & Lt., 7% pf.	*l*114	113‡	115
Tide Water Pwr., 8% pf.	106	108	112
Timken Roller Bear., com.—$4 no par	118‡	112‡	134
Toledo Edison, 7% pf.	109	108	111
Toledo Edison, 6% pf.	105	95	105
Toledo Edison, 6% com.	m145	120	150
Tri-City Ry. & Lt., 6% pf.	90	88	102
UNITED GAS & ELEC., 7% pf.	95	98	103
United Gas & Elec. (N. J.), 5% pf.	75	70	77
United Gas Impr., 8% com.—50	*c*134‡	114‡	149‡
United Lt. & Pwr., pf.—$4—no par	m 55	49	56‡
United Lt. & Pwr., pf.—$6.50—no par	101	95	101‡
United L. & P., com. A .48—no par	23‡	13‡	26‡
United L. & P., com. B .48—no par	28	20‡	31
Utah Pwr. & Lt., 7% pf.	*l*107‡	109‡	112
Utica Gas & Elec., 7% pf.	106	105	106‡
Utica Gas & Elec., 8% com.	m200	215	225
Utilities Pwr. & Lt., 7% pf.	98	98	104
Utilities Pwr. & Lt., com. A $2	37	28‡	45‡
Utilities Pwr. & Lt., com. B $1—no par	28	18‡	32‡
VERMONT HYDRO-ELEC., 7% pf.	99	95	102
Virginia Elec. & Pwr., 7% pf.	m108	108	111
Virginia Public Service 7% pf.	102	97	103‡
WAGNER ELEC., 7% pf.	*b*104	96‡	107
Wagner Elec., com.—no par	*b* 79‡	37	120
Washington Ry. & Elec., 7% com	*j* 450	....	....
Washington Ry. & Elec., 5% pf.	*j* 99‡	....	....
Washington Wtr. Pwr., 8% com.	225	175	235
West Penn Elec., 7% pf.	109‡	108	115
West Penn Elec., Cl. A $7	103‡	103	112
West Penn Pwr., 7% pf.	116‡	114‡	117‡
West Penn Pwr., 6% pf.	104‡	104	113
West Virginia Lt., Ht. & Pwr., 7% pf.	95	94	100
Western Pwr., 7% pf.	104	98	105
Western States Gas & Elec., 7% pf.	104	100	106
Western States Gas & Elec., com.	*n* 38	....	....
Westinghouse Elec. & Mfg., 8% com.—50	92‡	88‡	112
Weston Elec. Instrument, Cl. A $2—no par	m 32‡	30‡	40‡
Weston Elec. Instrument, com.—no par	m 22‡	12‡	28‡
Wheeling Elec., 6% pf.	106	95	109
Worthington Pump, 7% pf. A	*m* 49	46‡	58‡
Worthington Pump, 6% B	m 43	41	51
Worthington Pump, com.	30	28	37‡
YALE & TOWNE com. $5—25	m 70	68‡	84‡

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington; *k*Cleveland. *l*Bid price Wednesday, June 27. *m*Bid price Saturday, June 23. *n*Latest quotations available. †Dividend rate variable.

BARCELONA TRACTION PAYS EXTRA DIVIDEND.—Directors of the Barcelona Traction, Light & Power Company, Ltd., have declared an extra dividend of 1 per cent and the quarterly dividend of 1¾ per cent on the non-cumulative participating preferred stock, all payable June 30 to holders of record June 21. An extra distribution of like amount was made on this issue on June 30, 1927.

CONNECTICUT UTILITY INCREASES CAPITAL.—The Rockville-Willimantic Lighting Company, Willimantic, Conn., will increase its capital stock, as recommended by directors and approved by stockholders of the company, by issuing 11,996 shares of common stock of no par value and 1,000 shares of preferred stock par value $100. The latter issue will be offered to stockholders at par on July 1 at the rate of one share of new stock for each eight shares of old stock. There is $800,000 of preferred stock outstanding.

MASSACHUSETTS UTILITY CHANGES PAR OF STOCK.—The Webster & Southbridge Gas & Electric Company, Webster, Mass., has been authorized to change the par value of the company's stock from $100 to $25 and to offer an additional stock issue of $400,000.

NORTHEASTERN POWER DECLARES INCREASED COMMON DIVIDEND.—The directors of the Northeastern Power Corporation have declared a quarterly dividend of 25 cents per share on the common stock and the usual quarterly dividend of $1.50 per share on the class A stock, both payable July 1 to holders of record June 15. From July 1, 1927, to April 1, 1928, inclusive, the corporation paid quarterly dividends of 15 cents per share on the common stock.

INDIANA UTILITY INCREASES CAPITAL.—The Liberty Light & Power Company of Richmond, Ind., has filed papers with the Secretary of State increasing its stock from $75,000 common and the same amount preferred to $125,000 common and the same amount preferred.

OHIO RIVER EDISON DOUBLES STOCK.—The Ohio River Edison Company has increased its 7 per cent cumulative preferred stock from 60,000 to 120,000 shares of $100 par value and its no-par common stock from 300,000 to 600,000 shares.

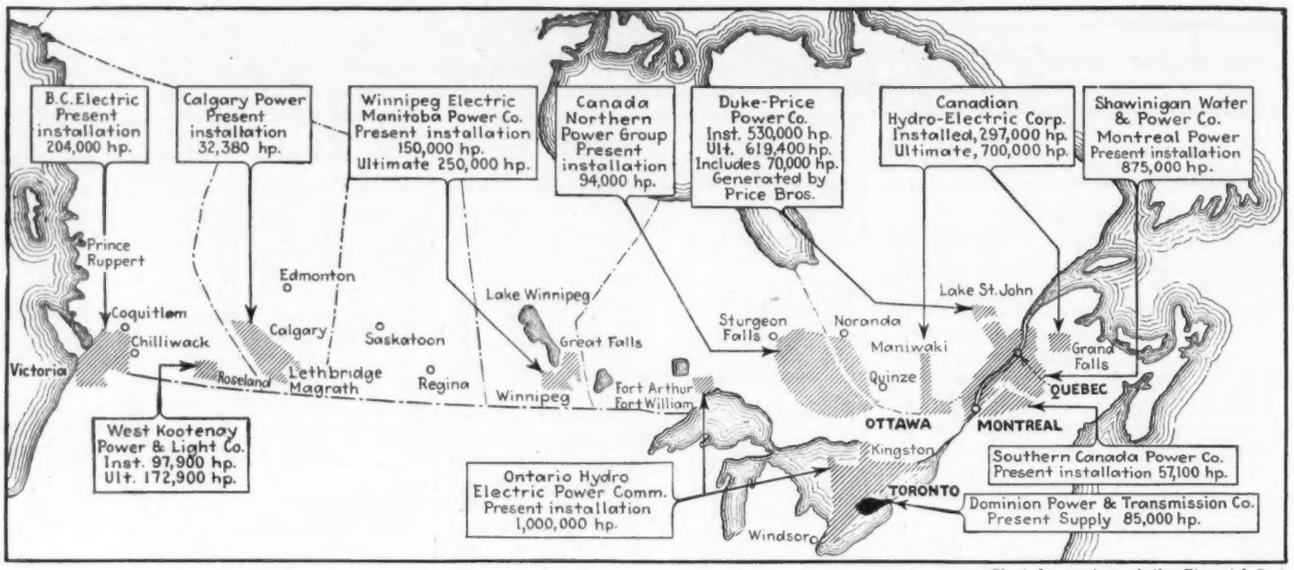


Chart by courtesy of the Financial Post.

Canada's present power installation is largely concentrated in the East

Reanalysis of Power Possibilities in Canada

DURING 1927 a reanalysis of the power possibilities in various districts throughout Canada has resulted in an increase in the total estimated available figures for the Dominion in spite of the fact that a recent judgment of the Privy Council takes from Canada and adjudges to Newfoundland a considerable area in Labrador, previously regarded as part of northeastern Quebec, in which large water powers are located. The most recent figures for the Dominion indicate the total resources to be 20,197,000 hp. under conditions of ordinary minimum flow, or 33,113,000 hp. ordinarily available for six months of the year.

Province	Available 24-Hour Power at 80 Per Cent Efficiency: At Ordinary Min. Flow, Hp.	At Ordinary Six Months Flow, Hp.	Turbine Installation, Hp.
British Columbia	1,931,000	5,103,500	473,142
Alberta	390,000	1,049,500	34,107
Saskatchewan	542,000	1,082,000	35
Manitoba	3,309,000	5,344,500	255,125
Ontario	5,330,000	6,940,000	1,816,908
Quebec	8,459,000	13,064,000	2,064,723
New Brunswick	87,000	120,800	47,231
Nova Scotia	20,800	128,300	70,017
Prince Edward Island	3,000	5,300	2,434
Yukon and Northwest Territories	125,200	275,300	13,199
Canada	20,197,000	33,113,200	4,777,921

The figures for available water power listed in the accompanying table are based upon rapids, falls and power sites of which the actual existent drop or the head possible of concentration is definitely established or at least well authenticated. Many rapids and falls of greater or lesser power capacity are scattered on rivers and streams from coast to coast which are not as yet recorded, and which will only become available for tabulation as more detailed survey work is undertaken and completed. This is particularly true in the relatively unexplored northern districts. Nor is any consideration given to the power concentrations which are feasible on rivers and streams of gradual gradient, where economic heads may be created by the construction of power dams, excepting only at points where definite studies have been carried out and the results made matters of record. In brief, the figures hereunder are based on definite rapids, falls and power sites, and may be said to represent the minimum water-power possibilities of the Dominion:

It is believed that these are conservative estimates, since an analysis of the water-power plants scattered from coast to coast concerning which complete data are available as to turbine installation and satisfactory information as to stream flow gives an average machine installation 30 per cent greater than the ordinary six-month flow power. Applying this, the figures quoted above, therefore, indicate that the present recorded water-power resources of the Dominion will permit of a turbine installation of approximately 43,000,000 hp.

PHILADELPHIA COMPANY PAYS EXTRA DIVIDEND.—Directors of the Philadelphia Company have declared an extra dividend of $1.50 per share on the common stock, payable July 31 to holders of record July 2. The regular quarterly dividend of $1 per share on this issue, previously declared, is payable on the same date.

MASSACHUSETTS UTILITY AUTHORIZED TO ISSUE STOCK.—The Massachusetts Department of Public Utilities has authorized the Edison Electric Illuminating Company of Boston to issue 32,230 shares of additional capital stock (par $25) at $45 per share.

Customer-Ownership Sales Rise

After several low months customer-ownership sales of stock rose in April to $19,794,000, involving 422,200 shares in 15,090 transactions, according to monthly reports received from electric light and power companies by the ELECTRICAL WORLD. The average of $1,300 per transaction is exceptionally high; the figure rarely rises above $800 or $900. In the present instance it is due to the combined influence of one campaign, which ran close to $2,000 per transaction, and of heavy sales by several other companies, each averaging well over $1,000 per transaction; the tendency toward sales in rather large blocks was quite general. The total for the month was close to the average for the year 1927, and since the heavy financing of last October was exceeded only in January, and then by 8 per cent.

Revised figures for March indicate the sale in 18,710 transactions of 194,900 shares valued at $11,569,000. The average per transaction, about $620, is in line with that of other months.

In March the sale of $25 shares exceeded $2,500,000 and in April it almost reached $8,000,000. Other shares were sold at prices close to $100. These large sales of low-priced shares account for the average of $60 per share in March and $47 in April.

Business News and Market Conditions

Record Manufacturing Operations During May

Electrical Manufacturing Plants Operating at the Rate of 17 per Cent Above Last Year—May Operations 5.6 per Cent Above April

THE electrical manufacturing industry entered the last month of the first half of the year with a rate of productive operations about 17 per cent over May of last year. Never before has such a high rate of activity been recorded by the industry as was witnessed during the current month of May. The former record activity was recorded in October of last year, but the May rate was about 2.4 per cent over that of last October.

The electrical manufacturing plants closed the year of 1927 in a rather unpromising manner, with a rate of operations about 4.7 per cent under December, 1926. A distinct downward trend was recorded as the year unfolded, March operations being about 8 per cent under those recorded in December. With April, however, came an unexpected radically upward turn, which was continued through May, the increase in the rate of activity for the two months' period being 17 per cent. Such an increase in the operations of these plants was not to be expected at this season of the year, in past years the usual upward turn not being started until September. All indications point to very unusual summer operations by the nation's electrical manufacturing plants.

The smaller electrical manufacturing plants reported a much greater increase of operations than was reported by the larger companies, but practically every plant reported substantial increases over May of last year.

The index of activities in the electrical manufacturing industry based on the consumption of electrical energy stands at 134.6 for May, as compared with 128.4 for April and 131.3 for the former record month of October, 1927. Comparative indexes of productive activity referred to the average of the period 1923-1925 as 100 and adjusted for number of working days are as follows:

May 1928	134.6
April, 1928	128.4
March, 1928	115.3
May, 1927	115.0
Average first five months 1928	124.9
Average first five months 1927	116.4

General industry has not recorded the same upward swing and record operations witnessed by the electrical manufacturing plants. Consumption of electrical energy by more than 3,000 large manufacturing plants in the United States in May was 0.2 per cent under the rate established in April and 1.3 per cent below that for the corresponding month last year. This is the first time since last September that industrial activity dropped below that of the same month in the year previous. May was the peak month of general industrial activity in 1927, while in the current year so far the high point was reached in February.

Lighting Fixture Award in National Competition

At the national competitive exhibit of residential luminaires held in connection with the convention and exhibit of the Artistic Lighting Equipment Association at Chicago this month a number of awards were offered for the development of something new in the line of lighting fixtures. The awards were intended to serve as a stimulus to the development of a new thought in fixtures, which it is expected will have sufficient power to encourage and make possible a refixturing activity.

The competition was held under the joint sponsorship of the committee on resident lighting equipment of the Association of Edison Illuminating Companies, the home lighting committee of the National Electric Light Association and the Electric Association of Chicago.

Prizes for units listing above $30 were made as follows:

First Prize, $300—Beardslee Chandelier Manufacturing Company.

Second Prize, $200 each—Duplexalite Division of the Miller Company and R. Williamson & Company.

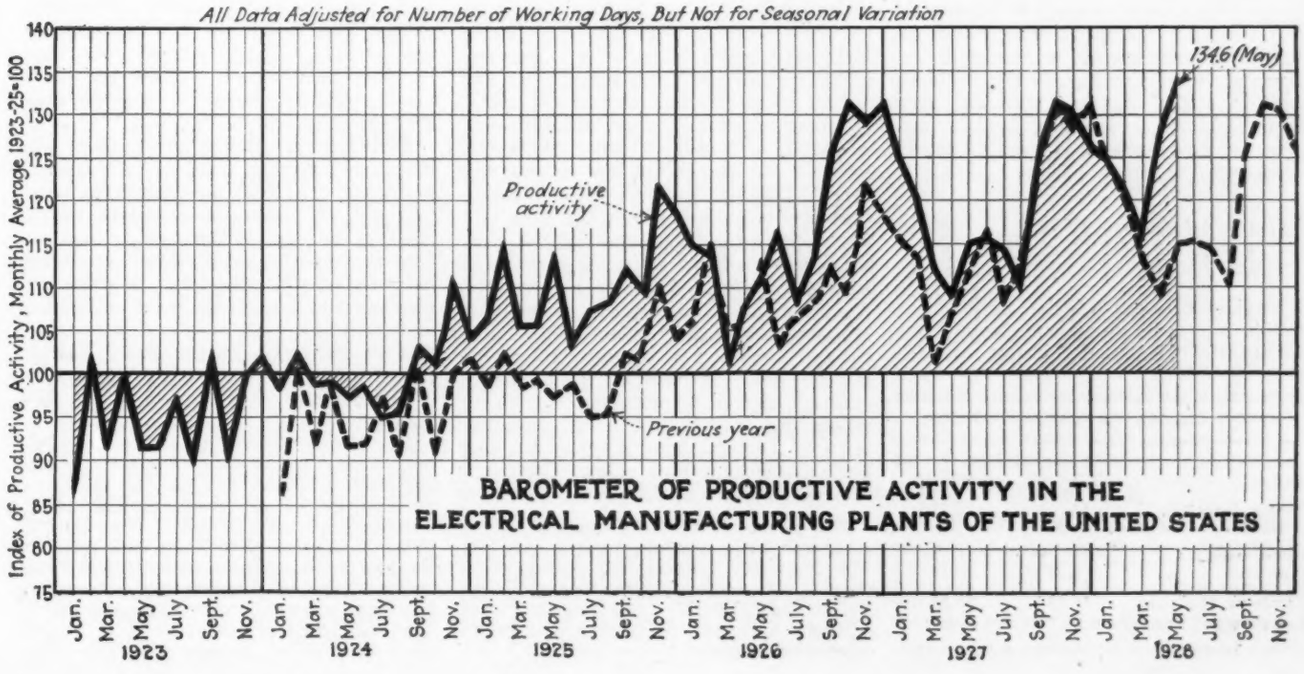
Honorable mention to the Edwin F. Guth Company.

Prizes for units listing below $30 were:

First Prize, $300—Miller Company.

Second Prize, $200—Lightolier Company.

The awards were made on the basis



of the best combination of the three essential factors that should be embodied in all equipment for home lighting:

1. Quality of illumination gaged by a sufficient quantity of light given without glare and objectionable shadows.
2. Excellence of workmanship in mechanical and electrical construction.
3. Artistry of design when viewed both lighted and unlighted in natural surroundings.

The two first of these factors were readily measured by scientific standards and all fixtures were tested in these respects in the Electrical Testing Laboratories, New York.

The third factor, that of beauty and appropriateness of design, was based on the aid offered by the lighting units to the American homemaker in having the equipment conform to the high standards of modern home decorating. The following constituted the board of judges: Harry H. Bentley, American Institute of Architects; W. McKee, Art Institute, Chicago; C. G. Everson, Artistic Lighting Equipment Association; L. H. Lamont, Association of Electragists International; L. V. James, Electric Association, Chicago; P. S. Millar, Electrical Testing Laboratories; W. H. Rademacher, Illuminating Engineering Society; E. D. Tillson, National Electric Light Association, and Mrs. Winifred Hathaway, National Society for the Prevention of Blindness.

Market Conditions

CENTRAL-STATION companies are buying line equipment and supplies in New England in increasing volume. Industrial orders are steady with small motors in good demand. An improved tone is noted in the Eastern market. A Maryland utility plans a generating plant to cost $500,000 and a New York engineering firm is planning a 30,000-hp. power plant in connection with an electric smelter to cost $5,000,000. A steam railroad purchased $75,000 worth of motor-generator sets for headlight service. Steel and iron mills, cement mills and chemical plants are prominent factors in current industrial commitments.

An increase in orders, both as to number and size, is reported in the Southeast. A new paper mill in Alabama will require more than $1,000,000 worth of electrical material. An improved tone continues in the St. Louis district. In the Middle West the volume of business transacted is increasing. On the Pacific Coast industrial plant buying has been active. Miscellaneous wiring and line material was purchased by a Utah smelter, $6,000 worth of turbine spare parts by a sugar refinery, and 72 motors by the National Paper Products Company.

Metal Markets Quiet and Steady

Buying of each of the non-ferrous metals has been of modest proportions during the past week. Prices are for the most part unchanged, copper continuing at 14¼ cents Connecticut and lead at 6.30 cents in New York and 6.15 cents in St. Louis. Zinc is a little firmer than a week ago, forward position commanding as high as 6¼ cents.

NEW YORK METAL MARKET PRICES

	June 20, 1928 Cents per Pound	June 27, 1928 Cents per Pound
Copper, electrolytic	14.525	13.75
Lead, Am. S. & R. price	6.30	6.30
Antimony	9¼	9¼
Nickel, ingot	35	35
Zinc spots	6.50	6.55
Tin, Straits	47	47
Aluminum, 99 per cent	24.30	24.30

Base copper wire price June 27, 1928, 16¼ cents.

Increase in Orders Reported in Southeast

Business is improving in the electrical field with increases noted in orders, both as to number and size. The largest order placed was for oil circuit breakers amounting to $100,000 for a power company in the western portion of the territory, while transformer and switching equipment amounting to $60,000 was ordered by a power company in Florida. Another central-station company ordered creosoted pine poles amounting to $10,000 and pole line hardware totaling $2,500. Some other central-station orders were for house type watt-hour meters amounting to $6,800, distribution and small power transformers amounting to $4,100 and poles totaling $2,200.

The electrical material requirements of a new paper mill being constructed in Alabama will approximate $1,000,000 and will include a 6,000 kw. turbine and three 1,000 hp. boilers. Electrification contracts have been closed on three cotton mills in the Carolinas and the electrical materials for these jobs will total $20,000, $10,000 and $8,000, respectively. A cotton mill in Georgia ordered wiring supplies costing about $6,000, for use in connection with a new mill lighting lay-out. A Georgia municipality ordered electrical pumping equipment amounting to $2,000, while another town in the same state purchased a carload of creosoted pine poles. Construction projects are as follows:

The Selma Compress Company, Selma, Ala., will build a plant, to cost $140,000. The Piedmont Corporation, Atlanta, Ga., plans a rock-crushing plant near Lithonia, Ga., to cost $300,000. The Georgia Power & Light Company, Waycross, Ga., plans extensions in plants to cost $300,000. The Tobacco By-Products & Chemical Corporation, Louisville, Ky., plans a power plant, at its proposed local chemical works, to cost $175,000. The Mississippi Power & Light Company, Jackson, Miss., plans a substation at Lexington, Miss. The Lampton-Reid Company, Magnolia, Miss., will build an electric-operated cotton ginning plant, to cost $50,000. Shelby, N. C., will make extensions in its light and power system to cost $16,000. Standard Looms, Inc., Spartanburg, S. C., will soon ask bids for a textile loom manufacturing plant at East Spartanburg, to cost $300,000. East Ridge, Tenn., plans an ornamental lighting system.

Improved Market Tone in Eastern District

Orders and inquiries in the Eastern district have shown noticeable improvement. A central-station company in New Jersey has placed a contract for a 50,000-kw. turbo-generator unit. A Maryland utility plans an addition to its generating plant to cost $500,000; a New York central station plans a large plant to represent an investment of several million dollars, and a New York engineering company has contracted to install a 30,000 hp. station in Chile.

Steel and iron mills, cement mills and chemical plants are prominent factors in current industrial commitments; the first noted is particularly strong with inquiries for industrial motors and accessory equipment, and future sizable orders are anticipated. A cement mill in Illinois has contracted for a number of motors for grinding mills, waste heat boiler fans and other service, totaling about $35,000. The same manufacturer has also secured an order from a chemical plant in Michigan for motor-generator units to an amount of about $50,000. A paper mill in West Virginia has given a commitment to another maker for a 400 kw. extraction turbine unit for process work, as well as for other apparatus, the total account approximating $100,000. Several automobile manufacturers in Michigan have entered the market for requirements for new plants and good business is looked for from this quarter. Wire and cable business holds satisfactory and the outlook is encouraging.

Philadelphia shows improvement in industrial business. Central station commitments are slow and inquiries have declined. A feature of immediate future business is local railway electrification. The city of Philadelphia has approved plans of the Philadelphia & Reading Railway for a terminal yard at Logan, in connection with proposed electrification of its Germantown and Chestnut Hill branches. Construction operations in the Eastern district include the following:

The J. G. White Engineering Corporation, New York, will build a power plant and electric smelter in Chile for the Electro-Siderurgical de Valdivia, now being organized, to cost $5,000,000. The General Cable Company, New York, will build a plant at Mobile, Ala., to cost $250,000. The Geller Shoe Manufacturing Company, Brooklyn, plans a factory to cost $100,000. The Sealright Corporation, Fulton, N. Y., plans an addition to cost $200,000. The

Koeppen Metal Products, Inc., Union City, N. J., will build a plant at Carlstadt, N. J., to cost $100,000.

The Susquehanna Collieries Company, Mount Carmel, Pa., will electrify its Cameron colliery, to cost $65,000. Drexel Institute, Philadelphia, will build an engineering building to cost $200,000. The Department of Property and Supplies, Harrisburg, Pa., will receive bids July 9, for cast iron lighting standards. Robert N. Dippy, Philadelphia, architect, is preparing plans for a cold storage plant to cost $100,000. The Eastern Shore Public Service Company, Salisbury, Md., plans a power plant at Vienna, Md., to cost $500,000. The International Paint Corporation, St. Helena, Md., plans a plant to cost $100,000.

Central-Station Companies Buying in New England

Expansions of power and service lines in New England are responsible for a gradual increase in the buying of line equipment and supplies. A number of orders for poles, cross arms and wire were reported, including an order for two carloads; several orders for switches and control apparatus were received, and insulators are selling well.

Industrial orders are steady with small motors in good demand. Activity is reported among manufacturers of fractional-horse power motors and the volume delivered in this district to date is in excess of that for the same period last year. Industrial heating is active. One manufacturer reports two orders for Western delivery consisting of 20 kw. and 30 kw. capacities for special heat treating. The general tone of the market is encouraging. Construction projects are as follows:

The Lynn Gas Light & Electric Company, Lynn, Mass., plans to expend $100,000 in linking up stations and connecting with power groups. The New England Power Company, Worcester, Mass., is to connect Pratts Junction with Lowell with a new line. A short line connection to a new transformer station will be soon made by the Randolph and Holbrook Power & Electric Light Company, Randolph, Mass. The Webster & Southbridge Gas & Electric Company, Webster, Mass., plans to expand its plant; a new power plant is planned by the Montan Company, Westboro, Mass. The Holyoke Company, Holyoke, Mass., plans additional machinery at its wire and cable works. The Bureau of Yards & Docks, Washington, D. C., will receive bids until July 5, for automatic refrigerating equipment for the naval station at Portsmouth, N. H. (Specification 5656). The Prairie Window Ventilator Corporation, Providence, R. I., plans an expansion to cost $85,000.

Most Sections of Middle West Report Active Business

Comparatively good business continues in most sections of the Middle West, and the volume is gradually increasing. It is expected that the month of June will show an increase in total business over the month of May. Industrial activity is somewhat spotty, although generally speaking it is considered good, with seasonal depressions here and there. Reports from the automobile industry indicate an excellent condition and the steel and railroad industries apparently are prosperous. There has been a good demand for poles, insulators, and other construction materials. An interesting order covered a 5,000-kva. distribution transformer. Jobbers' sales are normal with a slightly increasing volume of business. Construction projects are as follows:

The Art Engraving Company, Chicago, plans a plant to cost $250,000. Darling & Company, East St. Louis, Ill., plans an addition to its fertilizer plant to cost $100,000. The F. L. Bromley Properties, Inc., Detroit, will build a unit at its automotive plant, to cost $200,000. The Mount Clemens Pottery Company, Mount Clemens, Mich., plans additions, to cost $80,000; Waldron, Inc., Minneapolis, Minn., plans a laundry to cost $200,000. The Glaser Provision Company, Omaha, Neb., plans a packing plant, to cost $100,000. The Pyrometric Laboratory, Columbus, Ohio, plans a factory and laboratory to cost $90,000. The Kohler Company, Kohler, Wis., plans an addition to its pottery plant, to cost $100,000. The Invincible Metal Furniture Company, Manitowoc, Wis., plans an addition to its aircraft plant, to cost $100,000. The Weber Lifelike Fly Company, Stevens Point, Wis., will build an addition to its fishing tackle factory, to cost $80,000. The Houghton County Electric Company, Houghton, Mich., plans an improved lighting system at Red Jacket, Mich.

Improved Tone Continues in St. Louis District

The general condition of business in the St. Louis district continues to show an improved tone. Orders for small motors, transformers and equipment are being placed in good volume and are slightly better than for the same period last year. One order for a lot of motors to drive centrifugal pumps amounted to $1,500. Appliances are selling in good quantity. Fan business is very slow on account of cool weather. Some good-sized contracts for street lighting are being estimated. Utility companies are not buying actively at present. Construction projects are as follows:

C. M. Conoway, Dallas, Tex., and associates, plan an ice plant at Hoisington, Kan., to cost $250,000. The Southwestern Gas & Electric Company, Shreveport, La., plans a 66,000-volt transmission line from Shreveport to Marshall, La. Kennett, Mo., will receive bids until July 17, for Diesel oil engines, and other complete power plant equipment. The Scullin Steel Company, St. Louis, will make extensions, to cost $200,000. The Market Development Corporation, International Life Building, St. Louis, plans a cold storage plant to cost $175,000. The Oklahoma Gas & Electric Company, Oklahoma City, Okla., will build a transmission line from Washington to Etowoh, Okla., about 40 miles, to cost $65,000.

The West Texas Utilities Company, Abilene, Tex., plans a substation at Baird, Tex. The Martha Washington Candies Company, Chicago, plans an addition to its plant at Fort Worth, Tex., to cost $80,000. The Globe-El Paso Cotton Oil Company, Old Fort Bliss, Tex., plans new plants to cost $175,000. The Central Power & Light Company, San Antonio, Tex., will make extensions in its power plant at Falfurrias, Tex., to cost $20,000. Blackwell, Cushing, Lone Wolf, and Temple, Okla., plan ornamental lighting systems.

Industrial Buying Active on Pacific Coast

Industrial plant ordering has been good on the Pacific Coast and includes such orders as miscellaneous wiring and line material for a Utah smelter, $6,000 worth of turbine spare parts for a sugar refinery and a 100-hp. synchronous motor valued at $2,500 for a chemical plant. The state industrial heating load is estimated at and is said to be increasing annually by 10,000 kw. The increasing industrialization of the Pacific Coast is evidenced by the number of plants seeking Pacific Coast locations, such as the Fokker airplane interests, a steel plant and the Seiberling tire people. Hotel construction announced includes a $1,000,000 Biltmore Hotel for Phoenix and a chain of California highway hotels. Other interesting construction includes a $750,000 grain terminal for Portland, new quartermaster's warehouses and office buildings for Fort Mason, San Francisco, and a $1,000,000 apartment house for Seattle, Wash.

Lighting business is now one of the busiest branches of the California electrical industry. New installations are being planned by Madera, Woodland, Chico, San Anselmo, Sonora and Los Banos, and San Jose has awarded a contract amounting to $5,000. Power company purchasing includes miscellaneous maintenance material in small lots. The Pacific Gas & Electric Company's range campaign, lasting eight weeks, has resulted in the sale of 1,147 electric ranges.

The largest motor movement reported in the Puget Sound district included four 150-hp., fifty-four 50-hp. and fourteen from 15 hp. down, for the Chipper plant of the National Paper Products Company. The sale of a 1,000-gallon pump and a 100-hp. steam turbine for a pumping plant also is reported. Seattle is negotiating for the installation of a third generating unit at the Skagit hydro-electric project involving an outlay estimated at $350,000. Construction projects are as follows:

The Verde Central Mines, Inc., Jerome, Ariz., will build a mill and concentrating plant, to cost $150,000. The Evans Auto Loading Company, Detroit, plans a plant at Eureka, Calif., for the manufacture of battery boxes, to cost $100,000. The contracting officer, Quartermaster Corps, Fort Winfield Scott, Calif., will receive bids July 9 for Diesel engines for marine service (Circular 1). The Jacumba Land & Cattle Company, Jacumba, Calif., plans a power plant at Jacumba Hot Springs, to cost $50,000. The John O. Gilbert Chocolate Company, Jackson, Mich., plans a candy plant at Los Angeles, to cost $800,000.

The Great Western Power Company, San Francisco, will make extensions in the power substation at Oakland, Calif., to cost $35,000. The Union Pacific Railway Company, Portland, Ore., plans a grain elevator on Swan Island, to cost $650,000. Bakersfield, Los Angeles, Chico, Los Banos, Hanford, Pasadena, Glendale and San Leandro, Calif., plan ornamental lighting systems.

The Pacific Gas & Electric Company, San Francisco, plans an improved lighting system at San Anselmo, Calif.

Activities of the Trade

Westinghouse Battery Sold to New Company

Formal announcement has been made of the sale of the Westinghouse Union Battery Company of Swissvale, Pa., by A. L. Humphrey, president of the Westinghouse Air Brake Company. A new company, known as the Wubco Battery Corporation, has been organized, taking over the equipment, inventory, sales outlets and good will. The new company will be headed by J. L. Rupp as president. Mr. Rupp was a former executive of the old company and has been actively concerned in storage battery development and standards for the past fifteen years. The new company states that the manufacture of the same quality Westinghouse batteries will be carried on in the present plant at Swissvale.

General Cable to Build Plant in Mobile, Ala.

The purchase of a piece of land on tidewater in the city of Mobile, Ala., has been announced by the General Cable Corporation, which will erect a factory for the manufacture of electrical wires and cables. The officials of the company have for some time past been studying the situation in the Southern states, believing that inasmuch as their factories situated in the northern part of the United States are in a position to serve to good advantage all sections of the country with the exception of the southeastern portion, the addition of a Southern mill would be a logical development of the company's natural facilities.

The General Cable Corporation, which was formed last November, purchased the plants of the Baltimore Rolling Mills, formerly owned by the American Smelting & Refining Company, the Dudlo Manufacturing Company, the Rome Wire Company, the Safety Cable Company and the Standard Underground Cable Company. The corporaton, with headquarters at 420 Lexington Avenue, New York, now has fourteen plants making a complete line of all kinds of electrical wires and cables.

THE CUTLER-HAMMER MANUFACTURING COMPANY, Milwaukee, manufacturer of electric controlling devices, announces a new unbreakable attachment plug with an improved type of cord grip, designed particularly to lessen short-circuit hazards. The cord grip cap can be obtained in either bakelite brown or zinc gray finish.

THE EAGLE ELECTRIC MANUFACTURING COMPANY, 59 Hall Street, Brooklyn, N. Y., has placed on the market the new Eagle armor-clad appliance plug. The company also announces that it has adopted a strict wholesalers' policy and its dealer business is being turned over to Eagle distributors to handle; also that Charles F. Copeland has joined the active selling force of the company. Mr. Copeland will act as direct office representative in all territories east of the Mississippi and will help to build up electrical wholesale business.

"Mazda" Lamp Prices Reduced

For the eleventh time since 1920 the General Electric Company has announced a reduction in the prices of "Mazda" incandescent lamps effective July 1. The reductions average 14 per cent and apply to types which represent about 82 per cent of the total consumption of large "Mazda" lamps. The company states that this reduction brings the prices to less than half, or about 45 per cent, of the 1914 average. This great reduction in price becomes even more impressive when one considers that during the same period the lighting efficiency of "Mazda" lamps has been tremendously increased, the cost of materials has gone up, and the average wage paid to lamp makers has more than doubled.

It is because the public has concentrated the bulk of demand on the five lamps in the standard line of inside frosted "Mazda" lamps that the General Electric Company has been able to achieve increasing efficiency in mass production and greater economies in lamp distribution. The policy of the General Electric Company, as has been declared by President Gerard Swope, is that the savings thus achieved be shared with the public. The policy is again confirmed in the July 1 price reduction, which affords consumers savings of 3 cents and 5 cents on the most widely used types of "Mazda" lamps.

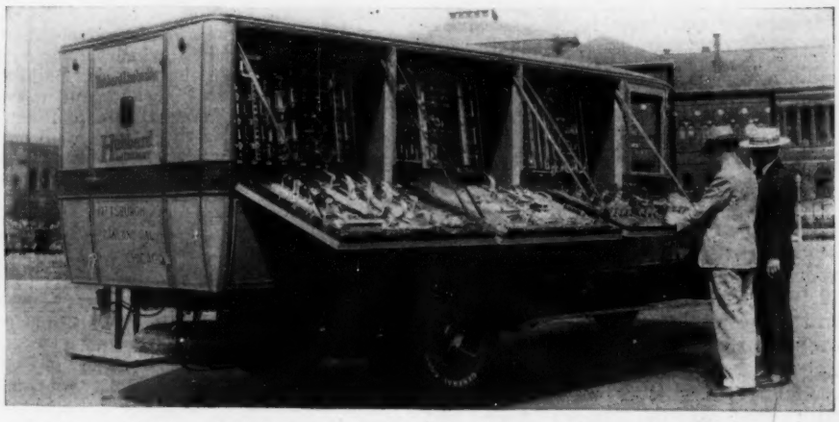
Lamp Size	Old Price, Cents	New Price, Cents
25 watt	23	20
40 watt	23	20
50 watt	25	22
60 watt	25	22
100 watt	40	35

Brown Boveri Approves Sale of Part of Holdings

The proposal to sell part of the holdings of the American Brown Boveri Corporation, as reported in the June 23 issue of the ELECTRICAL WORLD, was approved this week by holders of founders' stock at a special meeting called for the purpose. The company will sell its entire stock holdings in the Moloney Electric Company of St. Louis to Stifel, Nicolaus & Company of St. Louis and its shipbuilding business at Camden, N. J., to Laurence R. Wilder, a director of the American Brown Boveri Company, who, with his associates, has organized the Transoceanic Corporation. Both holdings will be sold for cash. The sales will enable the corporation to retire its bonded debt of slightly more than $5,000,000, to repay its bank loans and to reduce the outstanding preferred stock by $1,000,000.

Hubbard Adopts Display Truck for Touring Country

Exhibited for the first time at Young's Million Dollar Pier during the week of the 51st National Electric Light Association convention at Atlantic City, the Hubbard "Linebuilder," as shown in the illustration, will be used to demonstrate the company's line of pole-line hardware and Peirce construction specialties. The display truck consists of a 2½-ton White truck chassis with a special body. The equipment is displayed as used in the field and there are a number of loose samples for inspection. It is intended to make a tour of the country with the truck so as to place before companies or individuals interested a complete line of Hubbard products. The tour will be conducted by Hubbard sales engineers, who will have charge of the display truck while it is in their territories.



Hubbard "Linebuilder" with samples of pole-line hardware and construction specialties displayed as used in the field

Table I—Data on Output and P
Syst

These data include all lighting, power and electric railw

Line No.	Company* or System	Rank in 1927	1927							
			System Peak Load Kw. (Instantaneous)	System Peak Load (Est. Over Thirty-Minute Period) Kw.	Date of Instantaneous System Peak	Output for Year Kw.-Hr. (Including Purchased Energy)	Average Load in Kw. 1927	Peak Load Kw. (Instantaneous)	Peak Load (Est. Over Thirty-Minute Period) Kw.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	United States								
1	Buffalo, Niagara & Eastern Power Corporat on System (*C*).	1	732,400	715,1 0	Dec. 2	4,634,341,084	529,000	68 ,800	682,800
2	C mmonwealth Edison Company	2	952,000	916,000	Dec. 8	3,778,380,000	431,300	897,000	867,000
3	Edison United & Allied Co panies*	3	784,077	765,703	Dec. 13	2,877,090,621	328,400	731,964	710,714
4	Southern California Edison Company	4	448,900	.....	Dec. 9	2,421,357,098	276,300	422,700	.....
5	Pacific Gas & Electric Company*	5	439,568	.....	July 29	2,322,015,035	265,100	406,970	.....
6	Southeastern Power & Light Company System	6	.....	475,000	(*n*) Oct. 24	2,215,947,000	253,000	(*B*) 420,000	400,000
7	The Detroit Edison Company	7	447,500	(*a*) 443,800	Dec. 20	2,142,549,100	244,500	439,000	(*a*) 435,000
8	The Philadelphia Electric Company System (*T*)	8	455,000	447,300	Dec. 19	1,860,613,091	212,400	444,000	431,500
9	Duke Power Company*	9	.....	398,300	.....	1,745,776,428	199,300	.....	(*c*) 337,040
10	The West Penn Electric Company	10	.....	(*b*) 332,405	.....	1,727,565,353	197,200	.....	(*b*) 313,040
11	Public Service Electric & Gas Company (N. J.)	11	435,500	422,000	Nov. 28	1,701,886,359	194,300	415,000	408,000
12	North American Company (Mo., Ill. & Iowa System)	12	319,599	.....	Dec. 6	1,449,881,883	165,500	278,121	.....
13	The Montana Power Company	13	191,100	187,900	Mar. 1	1,366,997,834	156,000	188,400	186, 00
14	Western Pwr. Corp. Subs. (Cal. Properties Sys.) N. Am. Co.*	14	271,665	.....	July 20	1,351,590,977	154,300	251,660	.....
15	Duquesne Light Company	15	276,900	274,000	Jan. 24	1,328,526,578	151,700	284,260	.....
16	Mohawk Hudson Power Corporation System	16	.....	(*c*) 257,700	(*o*) May 25	1,249,808,094	142,700	.....	251,500
17	The Cleveland Electric Illuminating Company	17	293,731	285,000	Dec. 13	1,138,838,831	130,000	287,119	280,500
18	The Ohio Power Company	18	211,000	.....	Mar. 10	1,131,133,000	129,100	202,000	.....
19	New England Power Association and Subsidiaries*	19	.....	(*o*) 243,650	(*o*) Dec. 19	1,104,515,942	126,000	(*c*) 179,200	185,000
20	Appalachian Electric Power Company	20	216,000	.....	April 16	1,095,378,000	125,000	205,000	.....
21	North American Company (Wisconsin-Michigan System)	21	229,314	.....	Oct. 5	1,026,886,645	117,200	210,420	.....
22	Brooklyn Edison Company, Inc	22	265,000	263,000	Dec. 22	957,946,741	109,300	265,200	259,750
23	Columbia Gas & Electric Corporation System*	23	213,000	.....	Nov. 9	936,704,222	106,900	.....	.....
24	Consumers Power Company	24	225,919	225,804	Sept. 20	930,285,847	106,200	118,113	186,800
25	Pennsylvania Power & Light Company	25	(*A*) 203,002	.....	(*A*) Dec.	908,579,200	103,700	194,402	.....
26	Public Service Company of Northern Illinois	26	.....	(*G*) 154,044	.....	884,762,116	101,000	.....	(*G*) 139,809
27	Northern States Power Company (Del.) and Subsidiaries	27	.....	.....	.....	839,375,628	95,800	181,677	172,600
28	Puget Sound Power & Light Company	28	158,453	155,453	Dec. 21	787,258,688	89,900	135,665	134,600
29	Consolidated Gas Elec. Lt. & Pwr. Co. of Baltimore	29	.....	(*c*) 165,000	Nov. 21	786,877,691	89,800	.....	(*c*) 162,500
30	Utah Power & Light Company	30	(*A*) 118,678	.....	(*A*) Sept.	784,402,000	89,500	120,270	.....
31	Pennsylvania-New Jersey Power System (*V*)	31	(*i*) 140,000	(*b*) 132,350	June 28	782,173,960	89,300	150,000	(*c*) 142,240
32	The Edison Electric Illuminating Company of Boston	32	224,508	.....	Dec. 19	748,502,053	85,400	190,276	.....
33	The Tennessee Electric Power Company	33	137,800	129,000	Jan. 27	651,397,468	74,400	136,800	132,000
34	Pennsylvania Water & Power Company	34	(*i*) 127,000	(*c*) 120,200	Dec. 9	634,248,100	72,400	(*i*) 120,000	(*c*) 114,500
35	The Washington Water Power Company	35	128,120	113,570	Dec. 28	633,019,740	72,260	103,783	97,500
36	City of Los Angeles, Bureau of Power & Light	36	133,300	132,400	Dec. 21	584,279,702	66,700	121,700	120,200
37	Pennsylvania-Ohio Power & Light Company	37	.....	(*b*) 113,234	Feb. 15	574,290,447	65,600	(*c*) 120,667	125,000
38	War Department, U. S. A. (Muscle Shoals)	38	125,540	120,185	Nov. 29	565,609,500	64,600	106,400	102,500
39	Portland Electric Power Company	39	.....	(*b*) 120,900	Dec. 30	495,663,700	56,600	(*h*) 121,300	(*c*) 118,600
40	Ohio Public Service Company	40	.....	(*c*) 98,700	(*o*) July 27	495,593,161	56,600	.....	(*b*) 107,400
41	Kansas City Power & Light Company	41	.....	(*h*) 120,806	(*m*) Dec. 15	488,156,281	55,700	79,700	(*h*) 73,200
42	Carolina Power & Light Company	42	(*A*) 101,000	.....	(*A*) Dec.	426,426,000	48,700	(*L*) 95,000	.....
43	Pennsylvania Group of Associated Gas & Electric System*	43	89,500	87,000	Feb. 15	413,209,393	47,200	(*b*) 88,330	90,000
44	Northern New York Utilities, Inc.	44	97,580	97,580	Dec. 13	411,462,360	47,000	91,500	89,700
45	Virginia Electric & Power Company	45	.....	(*a*) 88,200	Dec. 9	409,680,096	46,700	.....	82,300
46	Minnesota Power & Light Company	46	(*A*) 77,950	.....	(*A*) Nov.	401,856,000	45,900	86,410	.....
47	Oklahoma Gas & Electric Company	47	.....	.....	.....	399,543,412	45,600	54,942	50,000
48	Indiana & Michigan Electric Company	48	90,110	.....	Dec. 13	390,808,000	44,600	91,490	.....
49	Potomac Electric Power Company	49	101,000	98,500	Dec. 19	383,128,587	43,700	91,500	90,000
50	Toledo Edison Company	50	.....	(*c*) 81,400	(*o*) Dec. 19	382,228,176	43,630	77,400	77,000
51	Northern Ohio Power & Light Company	51	.....	79,740	.....	379,630,884	43,300	.....	45,500
52	The California Oregon Power Company	52	.....	.....	.....	374,724,290	42,800	67,040	67,040
53	Houston Lighting & Power Company	53	(*A*) 75,000	.....	(*A*) Oct.	362,094,000	41,340	56,000	.....
54	Texas Power & Light Company*	54	(*A*) 84,200	.....	(*A*) Sept. 14	355,707,000	40,600	76,300	.....
55	Turners Falls Power & Electric Company	55	.....	.....	.....	354,762,797	40,500	74,800	65,000
56	The Connecticut Light & Power Company	56	.....	.....	.....	354,047,654	40,400	.....	(*b*) 69,870
57	Rochester Gas & Electric Corporation	57	80,150	71,670	Nov. 28	352,809,582	40,300	77,680	(*c*) 69,100

Supplement to ELECTRICAL WORLD, May 5, 1928

Peak Load of Largest Generating tems in North America

ilway systems in the United States, Canada and Mexico having yearly output in excess of 100,000,000 kw.-hr. durir

	1926			1925			1924			1923		
ad ver - e)	Date of Instantaneous Peak (11)	Output for Year Kw.-Hr. (12)	Average Load in Kw. 1926 (13)	Peak Load Kw. (Instantaneous) (14)	Date of Instantaneous Peak (15)	Output for Year Kw.-Hr. (16)	Peak Load Kw. (Instantaneous) (17)	Date of Peak (18)	Output for Year Kw.-Hr. (19)	Peak Load Kw. (20)	Date of Peak (21)	Out Y Kw (
800	Dec. 9	4,463,911,125	509,580									
000	Dec. 15	3,482,632,000	398,000	809,000	Dec. 23	3,091,424,000	717,000	Dec. 19	2,787,090,000	624,000	Dec. 4	2,573
714	Dec. 20	2,554,025,704	291,555	656,312	Dec. 21	2,262,620,409	615,283	Dec. 23	2,056,432,473	555,433	Dec. 5	1,899
....	Nov. 9	2,227,879,772	255,004	395,900	July 22	1,987,661,654	330,660	Mar. 10	1,664,151,512	312,500	Oct. 17	1,548
....	Dec. 22	2,157,886,980	246,334	380,084	Nov. 4	2,001,474,640	343,701	Dec. 19	1,887,113,680	306,945	Dec. 12	1,725
000	Oct. 8	1,966,393,998	224,210	291,000	Oct. 22	1,196,244,494						
000	Sept. 15	2,025,063,700	231,200	391,000	Oct. 2	1,732,420,700	335,800	Nov. 21	1,460,631,400	303,600	Dec. 5	1,360
500	Dec. 20	1,749,016,316	199,659	387,200	Dec. 10	1,521,639,979	334,048	Dec. 22	1,313,297,283	299,438	Dec. 27	1,148
040	(o) Dec. 13	1,433,759,975	163,500	(c) 297,705	(o) Jan. 12	1,187,872,330	(o) 287,000	Dec. 16	1,054,909,770	270,800	Dec. 11	1,001
040	(o) Dec. 8	1,514,609,984	172,901	.....	.....	1,316,521,920	.....	.....	1,196,885,215	.....	.....	1,140
000	Dec. 13	1,560,801,782	187,000	367,048	Dec. 9	1,358,318,172	335,689	Dec. 22	1,198,240,840	282,654	Dec 5	1,084
....	Dec. 8	1,337,733,243	152,500	258,623	Dec. 15	1,200,506,087						
00	Oct. 15	1,379,194,095	157,442	172,600	Aug. 14	1,234,052,127	159,150	Dec. 15	1,121,245,976	156,500	July 26	1,122
....	July	1,334,964,749	152,500									
....	Dec. 15	1,332,033,978	152,059	271,200	Dec. 16	1,230,292,597	239,380	Dec. 16	1,093,939,801	219,500	Nov. 20	1,063
500	Nov. 30	1,157,858,730	131,900	(n) 171,100	(n) Nov. 24	809,964,028						
500	Dec. 15	1,118,294,193	127,555	251,375	Dec. 17	989,409,700	227,954	Dec. 10	865,079,266	187,275	Dec. 20	802
....	Oct. 20	1,109,315,094	103,150	(n) 181,600	(n) Dec. 22	890,509,813						
000	(o) Oct. 20	716,087,950	77,800	(c) 165,200	(o) Jan. 20	681,696,046	(o) 151,200	Dec. 2	562,802,440	139,314	Oct. 23	575
....	Oct. 20	975,664,102	100,323	.....	.....	.....	.....	.....	.....	.....	.....	.....
....	Dec. 15	959,430,412	109,500	203,904	Dec. 4	849,064,272	156,179	Dec. 16	595,329,699	138,291	Nov. 27	553
750	Dec. 21	874,023,045	99,774	228,000	Dec. 17	783,019,562	201,600	Dec. 23	684,632,824	180,000	Dec. 20	598
800	Nov. 9	809,134,896	92,600	157,332	Sept. 15	686,548,440	146,789	Dec. 5	602,152,714	139,849	Sept. 18	574
....	Nov.	858,001,300	98,000	130,403	Dec.	707,995,258	135,335	Dec. 22	630,923,200	116,453	Nov.	602
809	Dec. 13	720,018,554	(G) 70,708	(d) 166,390	Dec. 9	(f) 615,092,925	(D) 115,392	Dec. 5	(E) 514,065,402	98,017	Dec. 4	427
600	Dec. 6	805,380,692	91,938	168,659	Dec. 2	742,601,203	156,619	Dec. 5	691,099,810	149,196	Nov. 26	636
500	Dec. 20	708,450,887	80,373	131,468	Dec. 10	632,626,358	125,000	Dec. 19	607,067,218	124,300	Dec. 19	577
500	Dec. 21	802,768,634	91,640	(b) 160,700	(o) Dec. 21	718,195,433	143,500	Dec. 23	648,307,210	138,410	Dec. 19	678
....	Dec.	801,444,000	91,500	112,343	Dec.	744,186,000	105,544	Dec.	749,653,000	105,452	Dec.	621
240	Oct. 20	937,689,159	107,000	.....	.....	.....	.....	.....	.....	.....	.....	.....
....	Dec. 17	673,760,354	79,909	203,199	Dec. 1	648,078,358	167,929	Nov. 24	564,459,887	153,123	Dec. 10	526
000	Jan. 12	653,812,207	74,636	155,000	Dec. 11	654,488,668	112,500	Dec. 10	477,593,985	93,700	March 5	460
500	June 22	631,681,400	72,100	115,000	Nov. 13	513,962,900	98,200	April 16	487,859,000	85,000	Jan. 3	420
500	Dec. 22	571,833,994	65,277	107,030	Oct. 30	515,523,750	91,824	Dec. 19	426,053,680	86,487	Nov. 9	413
200	Dec. 3	521,136,258	59,490	109,860	Dec. 16	479,878,822	101,162	Dec. 22	437,209,701	98,945	Dec. 13	426
000	Dec. 22	543,152,601	58,662	(i) 100,000	.....	417,368,862	75,000	.....	341,939,101	61,100	Jan. 19	340
500	Nov. 11	439,380,300	50,157	.....	.....	.....	.....	.....	.....	.....	.....	.....
500	Dec. 17	476,272,500	54,200	(d) 105,500	(o) Dec. 18	421,155,600	(o) 91,600	(o) Dec. 19	394,013,720	81,500	Dec. 20	365
400	(o) Jan. 15	535,078,389	(g) 102,180	104,100	Dec. 2	522,063,648	121,000	Dec. 3	417,544,531	92,723	Dec.	415
200	(m) Oct. 19	365,170,871	43,450	(m) 71,000	Dec. 4	339,117,030	(m) 67,723	Dec. 4	315,582,737	62,800	Sept. 27	289
....	.....	(L) 426,399,670	(L) 48,700	46,000	Nov.	160,646,601	25,000	Dec.	100,538,848	.....	.....	.....
000	Nov. 23	395,333,291	45,200	84,765	Dec. 22	341,630,292	69,300	Dec. 16	298,707,292	57,000	Jan.	182
700	Dec. 1	398,348,320	45,475	.....	.....	.....	.....	.....	.....	.....	.....	.....
300	(n) Dec. 9	377,662,174	43,114	(n) 79,440	(n) Dec. 15	304,400,743	.....	Dec. 23	276,663,178	56,400	Dec. 18	262
....	Oct.	399,825,337	45,600	75,484	Oct.	364,574,445	(o) 68,375	Sept. 29	340,181,750	50,300	May 22	251
000	Nov. 29	207,140,920	23,630	45,000	Nov. 24	156,979,298	36,456	Nov. 15	129,946,323	30,850	Dec.	108
....	Nov. 16	318,395,010	36,311	(b) 58,390	(o) Dec. 1	180,932,804	(o) 33,300	(o) Dec. 11	133,329,990	37,970	May 8	156
000	Dec. 15	350,024,224	65,068	84,000	Dec. 16	318,700,406	77,000	Dec. 23	286,695,035	70,000	Dec. 27	269
000	May 26	350,695,351	40,118	(k) 81,500	Oct. 21	350,518,281	77,000	Dec. 15	279,848,936	73,000	Dec. 5	273
500	.....	356,040,480	38,745	(n) 43,400	(n) Jan. 27	304,116,460	(n) 47,400	Jan. 9	267,074,055	46,400	Dec. 10	259
040	Dec. 6	293,010,721	32,737	(s) 67,180	Oct. 20	(t) 251,310,788	36,222	Dec. 10	180,554,058	32,463	Nov. 20	153
....	Dec.	263,299,360	30,000	39,250	Dec.	199,847,650	33,100	Nov. 25	161,307,120	27,400	Dec. 3	129
....	Dec.	339,468,000	38,800	57,830	Sept.	264,399,000	53,400	Sept. 4	262,187,000	37,570	Dec. 17	225
000	Oct. 6	321,816,370	36,800	71,800	July 2	317,772,280	56,700	Nov. 8	238,574,255	59,600	June 13	217
870	(o) Dec. 15	286,218,156	32,766	(b) 68,270	.....	287,165,218	.....	.....	227,558,428	50,900	Dec. 5	196
100	Dec. 1	326,148,706	37,232	72,070	Dec. 21	296,678,080	63,040	Dec. 13	267,233,764	61,824	Dec. 6	248

Output and Peak Load of Largest C Systems in North America

clude all lighting, power and electric railway systems in the United States, Canada and Mexico having yearly output

27			1926					1925							
of neous em k	Output for Year Kw.-Hr. (Including Purchased Energy)	Average Load in Kw. 1927	Peak Load Kw. (Instantaneous)	Peak Load (Est. Over Thirty-Minute Period) Kw.	Date of Instantaneous Peak	Output for Year Kw.-Hr.	Average Load in Kw. 1926	Peak Load Kw. (Instantaneous)	Date of Instantaneous Peak	Output for Year Kw.-Hr.	Peak Load Kw. (Instantaneous)	D			
	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)				
2	4,634,341,084	529,000	68 ,800	682,800	Dec. 9	4,463,911,125	509,580	.....	.....	.....	.....				
8	3,778,380,000	431,300	897,000	867,000	Dec. 15	3,482,632,000	398,000	809,000	Dec. 23	3,091,424,000	717,000	D			
13	2,877,090,621	328,400	731,964	710,714	Dec. 20	2,554,025,704	291,555	656,312	Dec. 21	2,262,620,409	615,283	D			
9	2,421,357,098	276,300	422,700	.....	Nov. 9	2,227,879,772	255,004	395,900	July 22	1,987,661,654	330,660	M			
29	2,322,015,035	265,100	406,970	.....	Dec. 22	2,157,886,980	246,334	380,084	Nov. 4	2,001,474,640	343,701	D			
24	2,215,947,000	253,000	(B) 420,000	400,000	Oct. 8	1,966,393,998	224,210	291,000	Oct. 22	1,196,244,494	.....	.....			
20	2,142,549,100	244,500	439,000	(a) 435,000	Sept. 15	2,025,063,700	231,200	391,000	Oct. 2	1,732,420,700	335,800	N			
19	1,860,613,091	212,400	444,000	431,500	Dec. 20	1,749,016,316	199,659	387,200	Dec. 10	1,521,639,979	334,048	D			
.....	1,745,776,428	199,300	.....	(c) 337,040	(o) Dec. 13	1,433,759,975	163,500	(c) 297,705	(o) Jan. 12	1,187,872,330	(o) 287,000	D			
.....	1,727,565,353	197,200	.....	(b) 313,040	(o) Dec. 8	1,514,609,984	172,901	.....	.....	1,316,521,920	.....	.....			
28	1,701,886,359	194,300	415,000	408,000	Dec. 13	1,560,801,782	187,000	367,048	Dec. 9	1,358,318,172	335,689	D			
6	1,449,881,883	165,500	278,121	.....	Dec. 8	1,337,733,243	152,500	258,623	Dec. 15	1,200,506,087	.....	.....			
1	1,366,997,834	156,000	188,400	186, 00	Oct. 15	1,379,194,095	157,442	172,600	Aug. 14	1,234,052,127	159,150	D			
20	1,351,590,977	154,300	251,660	.....	July	1,334,964,749	152,500	.....	.....	.....	.....	.....			
24	1,328,526,578	151,700	284,260	.....	Dec. 15	1,332,033,978	152,059	271,200	Dec. 16	1,230,292,597	239,380	D			
y 25	1,249,808,094	142,700	.....	251,500	Nov. 30	1,157,858,730	131,900	(n) 171,100	(n) Nov. 24	809,964,028	.....	.....			
13	1,136,838,831	130,000	287,119	280,500	Dec. 15	1,118,294,193	127,555	251,375	Dec. 17	989,409,700	227,954	D			
10	1,131,133,000	129,100	202,000	.....	Oct. 20	1,109,315,094	103,150	(n) 181,600	(n) Dec. 22	890,509,813	.....	.....			
c. 19	1,104,515,942	126,000	(c) 179,200	185,000	(o) Oct. 20	716,087,950	77,800	(c) 165,200	(o) Jan. 20	681,696,046	(o) 151,200	D			
16	1,095,378,000	125,000	205,000	.....	Oct. 20	975,664,102	100,323	.....	.....	.....	.....	.....			
5	1,026,886,645	117,200	210,420	.....	Dec. 15	959,430,412	109,500	203,904	Dec. 4	849,064,272	156,179	D			
22	957,946,741	109,300	265,200	259,750	Dec. 21	874,023,045	99,774	228,000	Dec. 17	783,019,562	201,600	D			
9	936,704,222	106,900	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....			
20	930,285,847	106,200	118,113	186,800	Nov. 9	809,134,896	92,600	157,332	Sept. 15	686,548,440	146,789	I			
Dec.	908,579,200	103,700	194,402	.....	Nov.	858,001,300	98,000	130,403	Dec.	707,995,258	135,335	D			
.....	884,762,116	101,000	.....	(G) 139,809	Dec. 13	720,018,554	(G) 70,708	(d) 166,390	Dec. 9	(f) 615,092,925	(D) 115,392	I			
.....	839,375,628	95,800	181,677	172,600	Dec. 6	805,380,692	91,938	168,659	Dec. 2	742,601,203	156,619	I			
21	787,258,688	89,900	135,665	134,600	Dec. 20	708,450,887	80,373	131,468	Dec. 10	632,626,358	125,000	D			
21	786,877,691	89,800	.....	(c) 162,500	Dec. 21	802,768,634	91,640	(b) 160,700	(o) Dec. 21	718,195,433	143,500	D			
ept.	784,402,000	89,500	120,270	.....	Dec.	801,444,000	91,500	112,343	Dec.	744,186,000	105,544	.....			
28	782,173,960	89,300	150,000	(c) 142,240	Oct. 20	937,689,159	107,000	.....	.....	.....	.....	.....			
19	748,502,053	85,400	190,276	.....	Dec. 17	673,760,354	79,909	203,199	Dec. 1	648,078,358	167,929	N			
27	651,397,468	74,400	136,800	132,000	Jan. 12	653,812,207	74,636	155,000	Dec. 11	654,488,668	112,500	D			
9	634,248,100	72,400	(i) 120,000	(c) 114,500	June 22	631,681,400	72,100	115,000	Nov. 13	513,962,900	98,200	A			
28	633,019,740	72,260	103,783	97,500	Dec. 22	571,833,994	65,277	107,030	Oct. 30	515,523,750	91,824	D			
21	584,279,702	66,700	121,700	120,200	Dec. 3	521,136,258	59,490	109,860	Dec. 16	479,878,822	101,162	D			
15	574,290,447	65,600	(c) 120,667	125,000	Dec. 22	543,152,601	58,662	(i) 100,000	.....	417,368,862	75,000	.....			
29	565,609,500	64,600	106,400	102,500	Nov. 11	439,380,300	50,157	.....	.....	.....	.....	.....			
30	495,663,790	56,600	(h) 121,300	(c) 118,600	Dec. 17	476,272,500	54,200	(c) 105,500	(o) Dec. 18	421,155,600	(o) 91,600	(o) D			
y 27	495,593,161	56,600	.....	(b) 107,400	(o) Jan. 15	535,078,389	(g) 102,100	104,100	Dec. 2	522,063,648	121,000	I			
ec. 15	488,156,281	55,700	79,700	(h) 73,200	(m) Oct. 19	365,170,871	43,450	(m) 71,000	Dec. 4	339,117,030	(m) 67,723	I			
Dec.	426,426,000	48,700	(L) 95,000	.....	.....	(L) 426,399,670	(L) 48,700	46,000	Nov.	160,646,601	25,000	.....			
15	413,209,393	47,200	(b) 88,330	90,000	Nov. 23	395,333,291	45,200	84,765	Dec. 22	341,630,292	69,300	D			
13	411,462,360	47,000	91,500	89,700	Dec. 1	398,348,320	45,475	.....	.....	.....	.....	.....			
9	409,680,096	46,700	.....	82,300	(n) Dec. 9	377,662,174	43,114	(n) 79,440	(n) Dec. 15	304,400,743	.....	D			
Nov.	401,856,000	45,900	86,410	.....	Oct.	399,825,337	45,600	75,484	Oct.	364,574,445	(o) 68,375	S			
.....	399,543,412	45,600	54,942	50,000	Nov. 29	207,140,920	23,630	45,000	Nov. 24	156,979,298	36,456	N			
13	390,808,000	44,600	91,490	.....	Nov. 16	318,395,010	36,311	(b) 58,390	(o) Dec. 1	180,932,804	(o) 33,300	(o) I			
19	383,128,587	43,700	91,500	90,000	Dec. 15	350,024,224	65,068	84,000	Dec. 16	318,700,406	77,000	D			
ec. 19	382,228,176	43,630	77,400	77,000	May 26	350,695,351	40,118	(k) 81,500	Oct. 21	350,518,281	77,000	D			
.....	379,630,884	43,300	.....	45,500	.....	356,040,480	38,745	(n) 43,400	(n) Jan. 27	304,116,460	(n) 47,400	J			
.....	374,724,290	42,800	67,040	67,040	Dec. 6	293,010,721	32,737	(s) 67,180	Oct. 20	(t) 251,310,788	36,222	D			
Oct.	362,094,000	41,340	56,000	.....	Dec.	263,299,360	30,000	39,250	Dec.	199,847,650	33,100	N			
pt. 14	355,707,000	40,600	76,300	.....	Dec.	339,468,000	38,800	57,830	Sept.	264,399,000	53,400	S			
.....	354,762,797	40,500	74,800	65,000	Oct. 6	321,816,370	36,800	71,800	July 2	317,772,280	56,700	N			
	354,047,654	40,400		(b) 69,870	(o) Dec. 15	286,218,156	32,766	(b) 68,270	.....	287,165,218	.....	.....			
49	Potomac Electric Power Company		49	101,000		98,500	Dec. 19	383,128,587	43,700	91,500	90,000				
50	Toledo Edison Company		50	.....	(c) 81,400	(o) Dec. 19	382,228,176	43,630	77,400	77,000					
51	Northern Ohio Power & Light Co.														

Generating and Distributing
ca

out in excess of 100,000,000 kw.-hr. during 1927

1924		1923			1922			1921			
Date of Peak (18)	Output for Year Kw.-Hr. (19)	Peak Load Kw. (20)	Date of Peak (21)	Output for Year Kw.-Hr. (22)	Peak Load Kw. (23)	Date of Peak Load (24)	Output for Year Kw.-Hr. (25)	Peak Load Kw. (26)	Date of Peak Load (27)	Output for Year Kw.-Hr. (28)	Line No. (29)
											1
Dec. 19	2,787,090,000	624,000	Dec. 4	2,573,286,711	600,000	Dec. 12	2,225,442,875	525,640	Dec. 21	1,928,271,943	2
Dec. 23	2,056,432,473	555,433	Dec. 5	1,899,679,975	497,577	Dec. 20	1,659,269,781	422,721	Dec. 14	1,475,276,053	3
Mar. 10	1,664,151,512	312,500	Oct. 17	1,548,896,120	239,160	Aug. 28	1,198,926,369	238,480	Dec. 13	1,224,718,196	4
Dec. 19	1,887,113,680	306,945	Dec. 12	1,725,619,492	293,708	Nov. 10	1,608,940,735	265,925	Nov. 29	1,489,088,657	5
											6
Nov. 21	1,460,631,400	303,600	Dec. 5	1,360,017,300	254,700	Dec. 7	1,105,211,100	201,500	Nov. 23	897,980,200	7
Dec. 22	1,313,297,283	299,438	Dec. 27	1,148,511,101	260,355	Dec. 14	956,910,225	213,570	Dec. 8	877,047,595	8
Dec. 16	1,054,909,770	270,800	Dec. 11	1,001,026,319	233,000	July	910,488,432	218,300	Feb.	790,000,000	9
	1,196,885,215			1,140,890,776							11
Dec. 22	1,198,240,840	282,654	Dec 5	1,084,990,294	249,778	Dec. 18	958,407,194	213,502	Nov. 28	821,198,975	11
											12
Dec. 15	1,121,245,976	156,500	July 26	1,122,750,450	135,600	Aug. 10	963,662,660	116,600	Jan. 1	572,277,989	13
											14
Dec. 16	1,093,939,801	219,500	Nov. 20	1,063,046,267	208,980	Dec. 13	858,329,336	164,240	Feb.	702,897,985	15
											16
Dec. 10	865,079,266	187,275	Dec. 20	802,859,991	181,112	Dec. 14	688,149,162	141,850	Dec. 15	564,819,267	17
											18
Dec. 2	562,802,440	139,314	Oct. 23	575,067,581	125,460	Dec. 14	469,993,180	112,200	Nov. 9	405,979,457	19
											20
Dec. 16	595,329,699	138,291	Nov. 27	553,624,392	134,482	Dec. 19	458,405,215	98,887	Nov. 22	375,354,892	21
Dec. 23	684,632,824	180,000	Dec. 20	598,808,757	164,495	Dec. 7	516,987,870	137,800	Dec. 6	438,887,775	22
											23
Dec. 5	602,152,714	139,849	Sept. 18	574,031,472	116,136	Dec. 4	461,840,561	95,410	Dec. 12	397,815,027	24
Dec. 22	630,923,200	116,453	Nov.	602,691,800	106,987	Nov. 14	495,344,612	84,203	Sept. 27	442,507,974	25
Dec. 5	(E) 514,065,402	98,017	Dec. 4	427,460,666	82,737	Dec. 19	362,220,201	80,563	Dec. 30	415,940,095	26
Dec. 5	691,099,810	149,195	Nov. 26	636,428,456							27
Dec. 19	607,067,218	124,300	Dec. 19	577,578,440	105,600	Dec. 4	474,042,886	99,800	Dec.	419,197,581	28
Dec. 23	648,307,210	138,410	Dec. 19	678,346,746	138,800	Dec. 13	568,669,404	108,330	Nov. 30	415,335,614	29
Dec.	749,653,000	105,452	Dec.	621,977,000	87,158	Dec. 19	428,912,903	75,661	Jan. 8	362,908,000	30
											31
Nov. 24	564,459,887	153,123	Dec. 10	526,465,178	133,594	Dec. 14	439,448,099	128,200	Dec. 15	375,025,955	32
Dec. 10	477,593,985	93,700	March 5	460,097,505	82,700	Dec. 11	353,320,559	69,100	May 16	342,948,926	33
April 16	487,859,000	85,000	Jan. 3	420,028,600	83,000	June 10	373,341,800	83,000	Nov.	419,987,000	34
Dec. 19	426,053,680	86,487	Nov. 9	413,240,900	89,278	Dec. 12	407,657,100	70,110	Nov. 23	374,378,300	35
Dec. 22	437,209,701	98,945	Dec. 13	426,337,964	75,275	Dec. 15	318,502,702	51,900	Dec. 21	300,353,806	36
	341,939,101	61,100	Jan. 19	340,864,488	64,200	Nov. 20	276,936,464	45,300	Nov. 9	202,670,200	37
											38
b) Dec. 19	394,013,720	81,500	Dec. 20	365,997,750	71,800	Dec. 28	324,116,190	64,800	Dec. 20	298,514,571	39
Dec. 3	417,544,531	92,723	Dec.	415,424,787	80,080	Nov.	316,838,000				40
Dec. 4	315,582,737	62,800	Sept. 27	289,903,699	59,490	Dec. 6	253,305,000	50,531	Dec. 23	204,752,604	41
Dec.	100,538,848										42
Dec. 16	298,707,292	57,000	Jan.	182,281,000							43
											44
Dec. 23	276,663,178	56,400	Dec. 18	262,940,313	54,250	Dec. 18	230,293,745	47,000	Dec. 14	208,323,000	45
Sept. 29	340,181,750	50,300	May 22	251,144,646							46
Nov. 15	129,946,323	30,850	Dec.	108,364,544							47
b) Dec. 11	133,329,990	37,970	May 8	156,333,990	37,450	Dec. 4	136,825,060	28,280	Dec. 16	105,593,490	48
Dec. 23	286,695,035	70,000	Dec. 27	269,870,850	70,000	Dec. 20	251,984,618	65,000	Dec. 14	238,028,571	49
Dec. 15	279,848,936	73,000	Dec. 5	273,643,372	58,000	Dec. 14	215,785,945	46,700	Dec. 13	179,121,428	50
Jan. 9	267,074,055	46,400	Dec. 10	259,720,216	43,000	Dec.	232,684,874	42,000	Oct. 12	187,249,647	51
Dec. 10	180,554,058	32,463	Nov. 20	153,500,531	27,695	Dec. 20	131,293,165	20,270	March 16	133,091,607	52
Nov. 25	161,307,120	27,400	Dec. 3	129,318,120	24,200	Nov. 22					53
Sept. 4	262,187,000	37,570	Dec. 17	225,453,000	66,560	Dec. 13	183,536,613	33,620	Sept. 22	156,861,213	54
Nov. 8	238,574,255	59,600	June 13	217,138,000	56,400	May 16	201,796,000	57,900	May 17	170,826,000	55
	227,558,428	50,900	Dec. 5	196,432,892	45,706	Dec. 14	158,371,247	28,255	Nov. 28	101,129,915	56
00 Dec. 15	350,024,224	65,068		84,000	Dec. 16		318,700,406	77,000	Dec. 23	286,695,035	70,000	Dec. 27	269
00 May 26	350,695,351	40,118	(k)	81,500	Oct. 21		350,518,281	77,000	Dec. 15	279,848,936	73,000	Dec. 5	273
00	356,040,480	38,745	(e)	43,400	(e) Jan. 27		304,116,460	(e) 47,400	Jan. 9	267,074,055	46,400	Dec. 10	259

	354,762,797	40,500	74,800		65,000		321,618,570		32,766		71,000							
	354,047,654	40,400		(b)	69,870	(o) Dec. 15	286,218,156		32,766	(b)	68,270			287,165,218				
49	Potomac Electric Power Company	49		101,000		98,500	Dec. 19		383,128,587		43,700		91,500		90,000			
50	Toledo Edison Company	50			(c)	81,400	(o) Dec. 19		382,228,176		43,630		77,400		77,000			
51	Northern Ohio Power & Light Company	51				79,740			379,630,884		43,300				45,500			
52	The California Oregon Power Company	52							374,724,290		42,800		67,040		67,040			
53	Houston Lighting & Power Company	53	(A)	75,000			(A) Oct.		362,094,000		41,340		56,000					
54	Texas Power & Light Company*	54	(A)	84,200			(A) Sept. 14		355,707,000		40,600		76,300					
55	Turners Falls Power & Electric Company	55							354,762,797		40,500		74,800		65,000			
56	The Connecticut Light & Power Company	56							354,047,654		40,400			(b)	69,870			
57	Rochester Gas & Electric Corporation	57		80,150		71,670	Nov. 28		352,809,582		40,300		77,680	(c)	69,100			
58	Idaho Power Company	58	(A)	70,245			(A) Dec.		352,253,000		40,200		47,990					
59	Indianapolis Power & Light Company*	59				63,500			328,712,384		37,500							
60	New Orleans Public Service, Inc.	60	(A)	66,500			(A) Oct.		319,842,000		36,500		66,000					
61	Central Indiana Power Company Subsidiaries	61		74,100		74,000	Sept. 7		305,326,889		34,850		80,070		76,790			
62	Central Illinois Public Service Company	62				72,600	(n) Dec. 6		301,548,168		34,400				74,600			
63	Birmingham Electric Company	63	(A)	53,811			(A) Dec.		289,073,000		33,000		41,692					
64	Public Service Company of Colorado	64			(c)	63,980			285,892,553		32,600		67,080		66,000			
65	Southern Sierras Power Company (S)	65		57,600			July 13		279,334,470		31,900		50,200					
66	City of Seattle, Department of Lighting	66		75,000		75,000	Dec. 9		277,591,025		31,690		64,800		60,000			
67	Wisconsin Power & Light Company	67		(N)		(N)	(N)		275,376,599		31,400		62,000		60,000			
68	Michigan Northern Power Company	68			(q)	35,958	(q) Dec.8		271,701,688		31,000							
69	Northern Indiana Public Service Company (K)	69				44,990	Nov. 30		271,440,543		30,990				44,750			
70	South Carolina System (W)	70	(i)	62,000	(b)	57,400	Sept. 23		266,235,456		30,400		58,000	(c)	55,100			
71	Empire District Electric Company	71			(c)	61,000	(o) Aug. 31		262,409,515		29,950		62,280		62,000			
72	Columbus Electric & Power Company and Subsidiary	72		74,220		73,000	May 25		260,726,212		29,760		69,540		68,000			
73	Northwestern Electric Company	73	(A)	48,100			(A) Dec.		255,766,000		29,200		44,400					
74	Columbus Railway, Power & Light Company	74				55,100	Dec. 8		254,843,000		29,100							
75	Louisiana Power & Light Company (O)*	75							250,542,000		28,600		34,000					
76	Los Angeles Gas & Electric Corporation	76		74,000		74,000	Dec. 21		247,191,413		28,200		68,200		68,200			
77	Texas Electric Service Company	77							241,723,000		27,600							
78	Scranton Electric Company	78		51,000			Feb. 15		237,512,000		27,100		54,020					
79	Interstate Public Service Company	79		58,600		46,880	Oct. 20	(P)	237,227,562		27,050		57,800					
80	Louisville Gas & Electric Company (Del) and Subsidiaries	80							234,238,160		26,750							
81	Penn Central Light & Power Company	81				45,000			226,892,235		25,900		62,500		62,450			
82	United Illuminating Company (U)	82							222,132,700		25,350		31,000		30,600			
83	Kansas Gas & Electric Company	83	(A)	44,600			(A) Dec.		221,118,000		25,200		44,400					
84	Central Maine Power Company (I)	84			(b)	48,600	(o) Dec. 16		220,727,440		25,175			(c)	43,800			
85	Hartford Electric Light Company	85			(F)	51,300	Feb. 17		220,324,000		25,100		67,000	(Y)	67,000			
86	Florida Power & Light Company	86	(A)	65,364			(A) Jan. 12		214,167,000		24,450		64,000					
87	Illinois Electric Power Company	87		53,010		52,000	Dec. 7		213,752,872		24,400		43,000		42,000			
88	Central Hudson Gas & Electric Corporation	88			(o)	52,900	(o) Dec. 15		212,368,156		24,240							
89	Salt River Valley Water Users' Association	89		53,275			Aug. 24		206,356,017		23,550		24,750					
90	Nebraska Power Company	90	(A)	41,900			(A) Dec. 21		201,094,000		22,950		38,800					
91	City of Tacoma, Light Division, Dept. Pub. Util	91		61,500		61,500	Dec. 30		197,580,149		22,500		55,000		40,300			
92	East Penn Electric Company	92	(A)	36,420			(A) Dec. 20		195,180,800		22,300		33,366					
93	Kentucky Utilities Company	93		45,800		44,000	Dec. 5		185,904,592		21,200	(i)	34,100	(i)	34,100			
94	Arkansas Power & Light Company	94							183,843,000		21,000		43,500					
95	City of Cleveland, Division of Light & Power	95		33,700		33,700	Dec. 19		174,146,677		19,900							
96	New Bedford Gas & Edison Light Company	96		50,500		48,000	Jan.4		173,617,378		19,800		52,600		50,000			
97	Dallas Power & Light Company	97	(A)	44,300			(A) Dec. 23		171,925,970		19,620		35,100					
98	Pacific Power & Light Company	98	(A)	35,105			(A) Dec.		171,611,000		19,590		27,677					
99	Kentucky & West Virginia Power Company	99		9,800			Aug. 8		168,960,000		19,280		10,000					
100	Memphis Power & Light Company	100	(A)	46,000			(A) Dec.		166,244,000		18,980		36,392					
101	Blackstone Valley Gas & Electric Company	101			(c)	52,200	(o) Dec. 7		165,318,271		18,870			(b)	51,792			
102	Atlantic City Electric Company	102		36,000			Sept. 3		157,892,000		18,000		29,000					
103	Gulf States Utilities Company	103		29,754		27,500	July 20		155,783,691		17,780	(i)	22,000		20,000			
104	Wisconsin Public Service Corporation	104							153,364,676		17,500			(c)	33,200			
105	Central Georgia Power Company	105				42,120			143,260,369		16,350							
106	Fort Worth Power & Light Company	106	(A)	48,500			(A) April		140,230,159		16,000		51,500					
107	Edison Electric Company of Lancaster, Pa.	107	(A)	30,200			(A) May 19		135,474,100		15,470			(c)	28,850			
108	Public Service Company of Oklahoma	108	(i)	39,222		35,300	Dec. 8		135,199,859		15,440							
109	Central Illinois Light Company	109		31,727		92,500	Dec. 15	(R)	135,692,265		15,490		28,600		27,500			
110	Des Moines Electric Light Company	110		40,000		36,400			134,416,934		15,340		32,000		31,000			
111	Indiana Service Corporation	111		34,000		34,000	Nov. 30		131,861,909		15,030		32,900		31,500			
112	Moline-Rock Island Mfg. Company	112		31,570		31,000	Nov. 28		131,017,494		14,950		32,530		32,000			
113	San Diego Consolidated Gas & Electric Company	113							126,801,100		14,480		31,900		31,000			
114	Central Power & Light Company	114				25,205			120,521,353		13,760							
115	Cumberland County Power & Light Company	115				30,580			116,194,720		13,260				29,740			
116	Salem Electric Lighting Company	116		27,000		27,000	Dec. 16		115,393,187		13,170		26,600					
117	Tampa Electric Company and Subsidiaries	117		25,340			Jan. 1		114,195,401		13,030				27,620			
118	The Worcester Electric Light Company	118		35,000		34,500	Dec. 13		112,890,480		12,880		32,500		30,000			
119	Delaware Electric Power Company*	119			(o)	25,000	(o) Dec. 21		109,786,578		12,530		22,500					
120	Fall River Electric Light Company	120		30,500			Nov. 28		108,254,302		12,360							
121	The Staten Island Edison Corporation	121		29,000	(c)	25,600	Feb. 16		107,715,140		12,290		31,500	(c)	30,000			
122	Indiana General Service Company	122		24,600			Nov. 20		105,634,000		12,060		23,140					
123	Augusta-Aiken Railway & Electric Corporation	123		19,200		19,200	Dec. 12		102,229,660		11,670							
124	United Electric Light Company (Springfield, Mass.)	124		36,800		36,800	Sept. 20		101,315,500		11,570		35,830					
	Total (C)								73,607,219,200									
	Canada																	
1	Hydro-Electric Power Commission of Ontario	1		746,275	(M)	740,530	Dec. 1		4,133,501,842		471,900		711,220	(M)	704,042			
2	Shawinigan Water & Power Company	2		420,300		420,300	Oct. 18		3,021,201,950		345,000		392,330		392,330			
3	Duke-Price Power Company, Ltd.	3							1,719,820,588		196,300							
4	Montreal Light, Heat & Power Consolidated	4		256,760		254,000	Dec. 14		1,354,895,244		154,700		252,000		252,000			
5	Laurentide Power Company, Ltd.	5		126,000		126,000	June 22		853,887,000		97,500							
6	Canadian Niagara Power Company, Ltd.	6							604,597,700		69,000							
7	Winnipeg Electric Company (J)	7		112,000		107,500	Nov. 10		511,103,200		58,400		66,200		62,200			
8	West Kootenay Power & Light Company, Ltd.	8				65,600	Aug. 11		476,999,100		54,400				63,300			
9	City of Winnipeg Hydro-Electric System	9		75,834		72,100	Dec. 13		358,371,100		40,900		70,844		68,144			
10	British Columbia Electric Ry. Co., Ltd. (Mainland System)	10	(p)	87,400	(c)	86,600	Dec. 21		350,402,700		40,000		79,000		77,200			
11	Canada Northern Power Corporation, Ltd. System	11		43,690		34,850	Dec. 22		305,415,945		34,800							
12	Dominion Power & Transmission Company, Ltd.	12		56,300		53,000	Nov. 24		253,859,900		28,980		53,200		53,200			
13	Ottawa & Hull Power Company (H)	13		45,100			Nov.8		213,670,326		24,390		42,250		39,860			
14	Southern Canada Power Company, Ltd.	14				26,300	Nov. 10		125,319,394		14,300							
15	Kaministiquia Power Company, Ltd.	15		23,300		21,600	Nov.28		104,071,000		11,880		26,700	(p)	26,000			

19	383,128,587	43,700	91,500	90,000	Dec. 15	350,024,224		65,068		84,000	Dec. 16	318,700,406		77,000				
ec. 19	382,228,176	43,630	77,400	77,000	May 26	350,695,351		40,118	(k)	81,500		350,518,281		77,000				

		227,558,428	50,900	Dec. 5		196,432,892	45,706	Dec. 14		158,371,247	28,255	Nov. 28		101,129,915	56			
000	Dec. 15	350,024,224		65,068		84,000		Dec. 16		318,700,406	77,000		Dec. 23	286,695,035	70,000	Dec. 27		269
000	May 26	350,695,351		40,118	(k)	81,500		Oct. 21		350,518,281	77,000		Dec. 15	279,848,936	73,000	Dec. 5		273
500		356,040,480		38,745	(n)	43,400	(n)	Jan. 27		304,116,460	(n) 47,400		Jan. 9	267,074,055	46,400	Dec. 10		259
040	Dec. 6	293,010,721		32,737	(s)	67,180		Oct. 20	(t)	251,310,788	36,222		Dec. 10	180,554,058	32,463	Nov. 20		153
....	Dec.	263,299,360		30,000		39,250		Dec.		199,847,650	33,100		Nov. 25	161,307,120	27,400	Dec. 3		129
....	Dec.	339,468,000		38,800		57,830		Sept.		264,399,000	53,400		Sept. 4	262,187,000	37,570	Dec. 17		225
000	Oct. 6	321,816,370		36,800		71,800		July 2		317,772,280	56,700		Nov. 8	238,574,255	59,600	June 13		217
870	(o) Dec. 15	286,218,156		32,766	(b)	68,270				287,165,218				227,558,428	50,900	Dec. 5		196
100	Dec. 1	326,148,706		37,232		72,070		Dec. 21		296,678,980	62,069		Dec. 12	267,223,754	61,824	Dec. 6		248
....	Aug.	266,320,000		30,400		38,555		Aug.		198,959,000	48,238		May	218,464,000	40,016	Aug.		222
....	Dec.	222,927,000	(X)	32,100		65,000		Dec.		252,735,540	56,000		Dec. 12	226,584,380	51,700	Dec.		211
790	Dec. 18	334,518,201		38,187		74,800		Dec. 8		262,971,086								
600	(n) Dec. 21	278,626,089		31,750		65,000		Nov. 18		247,311,779	53,500		Dec. 30	202,871,998	42,300	Sept. 5		174
....	Oct.	200,750,534		22,900		35,919		Dec.		224,109,866	37,749		Dec. 10	193,987,141	35,202	Dec. 5		162
000	Dec. 14	268,618,910		30,700		58,645		Dec. 22		244,055,341	55,000		Dec. 22	216,151,037				145
....	June 30-July 1&2	273,230,332		31,191		49,900		July 16		260,300,140	40,500		June 7-Oct. 21	226,680,958	40,100	June 11		219
000	Dec. 14	232,848,275		26,581		59,600		Dec. 29		218,245,950	50,800		Dec. 9	152,125,000	35,600	Dec. 7		115
000	Dec. 7	258,765,399		29,500														
....		150,060,345		24,666	(q)	33,084	(q)	Aug. 22		252,186,398	(q) 30,297	(q)	Dec. 9	258,750,604	34,510	Oct. 19		261
750	Dec. 8	227,490,211		25,969		32,796		Dec. 22		170,852,661	28,800		Dec. 23	149,220,978				
100	Dec. 21	261,690,006		29,800														
000	Nov. 23	214,669,321		24,730	(u)	59,260		Jan. 1		178,047,098	41,200		Dec. 17	148,402,996	58,826	May		152
000	June 23	257,540,000		29,400		52,040		Nov. 4		204,811,841	38,910		Dec. 5	156,732,805	36,310	Oct. 16		160
....	Dec.	237,403,000		27,100		39,300		Dec.		196,911,791	(B) 34,500			188,771,500	30,900	Dec. 19		152
....	Dec.	122,937,000		14,000														
200	Dec. 23	213,459,806		24,361		58,300		Dec. 17		184,683,171	69,000		Nov. 5	245,047,430	43,500	Dec. 18		122
....	Nov. 22	214,065,156		18,371		46,300		Aug. 6		197,864,432	(n) 39,800		Dec. 23	164,162,797				
....	Nov. 4	(P) 243,812,849	(P)	27,850														
....		222,310,255		25,350		56,250		Dec. 8		217,377,479	48,700		Dec. 23	168,403,952	40,650	Dec. 5		143
450	Nov. 30	227,630,419		25,668		46,300		Dec. 14		208,994,394	40,100		Dec. 30	165,364,793	36,100	Dec 20		147
600	Nov.	115,535,700		26,000														
....	Dec.	194,417,500		22,200		35,800		Dec.		177,590,200	35,200		Dec.	163,783,700	33,000	Dec 3		166
800	(o) Dec. 17	183,268,485		20,921	(q)	628,410		Dec. 30		174,943,577	(o) 33,300			154,117,396	32,200	Dec 3		146
000	Aug. 26	192,253,000		26,000		56,400		May 1		190,355,000	54,700		Nov. 19	163,178,438	60,200	{ Oct 23 / Nov 22 }		18
....	Feb.	173,623,725		19,900														
000	Aug. 20	165,088,310		19,400														
....	Sept. 3	113,107,669		(e)														
....	Sept. 22	187,052,800		21,350		30,500		Oct.		177,233,500	34,700		Dec 18	166,110,700	34,000	Dec 19		166
300	Oct. 11	195,791,000		22,000		33,000		Dec. 29		157,662,360	33,400		Dec. 19	147,218,203	29,600	Dec 7		136
....		176,135,500		20,100														
100	(i) Dec. 21	146,560,259		16,700														
....	Dec.	151,908,790		17,300														
....		164,932,820		18,800	(n)	31,000		Dec. 21		151,475,140								
000	Dec. 20	172,222,651		19,860		50,300		Dec. 1		155,470,639	48,800		Dec. 22	121,512,151	47,782	Jan 3		13
....	Nov.	159,430,750		18,200		36,400		Dec.		144,739,433	31,700		Dec. 22	127,924,350	16,300	Dec 3		10
....	Dec.	166,214,470		19,000	(i)	35,000		Aug.		155,585,707				137,304,890	25,000	Sept		11
....	April 13	137,256,705		4,679														
....	Dec.	137,786,000		15,700		34,300		Dec.		121,627,000	31,700		Dec. 22	112,743,000				
792	(o) Nov. 30	153,976,958		17,577		48,000		Dec. 21		138,876,293	(o) 41,440		Dec. 18	124,813,962	40,060	Dec 10		12
....	Sept. 4	106,141,300		12,111														
000	(l) Dec. 2	100,344,073		11,455														
200	(o) Nov. 17	150,635,115		29,067		30,400		Dec. 4		(w) 128,835,193	35,000		Dec.	113,239,516				
....	Dec.	155,794,457		17,800		51,500		Dec.		183,622,525	50,000		Dec. 31	257,757,000	45,067	Dec 18		24
850		125,911,263		14,373	(x)	30,300		(y)		118,617,000	(B) 26,400		Dec. 10	107,440,900	24,600	Nov 27		10
500	Dec. 21	117,679,234		13,000		25,800		Sept. 30		106,992,465								
000	Nov. 8	128,293,150		13,800														
500	Dec. 13	123,632,339		14,110														
000	Sept. 14	124,713,651		14,237		30,000		Dec. 4		108,316,069								
000	Nov. 1	123,369,160		13,400		27,300		Dec. 18		117,956,180								
740		107,971,800		12,325														
....	Dec. 28	100,874,562		11,515														
620	Dec. 7	100,462,550		11,468														
000	Dec. 13	105,039,000		11,991		38,900		Feb. 4		108,822,300								
....	Aug. 13	111,341,210		11,263														
000	Feb. 19 & 23	100,957,540		11,525														
....	Dec. 8	104,648,573		11,644														
....	Jan. 18	109,818,700		12,538														
042	Nov. 19	3,867,398,041		441,483		635,485		Dec. 8		3,298,347,874	576,403		Dec. 22	3,026,615,156	520,084	Nov. 27		2,90
330	Dec. 9	2,557,613,443		292,000		371,002		Nov. 24		2,421,046,311	347,448		Nov. 7	2,066,066,762	272,500	Nov. 7		1,66
000	Nov. 22	1,251,502,612		142,800		233,230		Dec. 9		1,175,430,654	221,060		Dec. 24	1,157,648,660	197,565	Nov. 8		1,08
		591,893,200		67,600														
200	Dec. 1	285,508,300		32,592		61,100		Jan.		252,891,600								
300		410,327,600		46,820														
144	Dec. 20	324,993,710		37,100		60,321		Dec. 31		261,996,380	46,065		Oct. 28	200,520,080	39,835	Nov. 20		16
200	Dec. 16	333,654,900		38,088		83,100		Dec. 22		336,907,650	75,200		Dec. 9	300,456,350	32,700	Dec. 29		12
200	Dec. 15	241,355,956		21,105														
860	Dec. 2	177,990,960		20,319														
000	Nov. 26	144,638,800		16,500		28,000		Sept. 30		107,576,036								
	Dec. 17	155,525,990	37,970	May 6		136,533,990	37,450	Dec. 4		136,825,060	28,280		Dec. 16	105,593,490	48			
	Dec. 23	286,695,035	70,000	Dec. 27		269,870,850	70,000	Dec. 20		251,984,618	65,000		Dec. 14	238,028,571	49			
	Dec. 15	279,848,936	73,000	Dec. 5		273,643,372	58,000	Dec. 14		215,785,945	46,700		Dec. 13	179,121,428	50			

12	Dominion Power & Transmission Company, Ltd.	12	56,300		53,000	Nov. 24	253,859,900		28,980		53,200		53,200					
13	Ottawa & Hull Power Company (*H*)	13	45,100			Nov.8	213,670,326		24,390		42,250		39,860					
14	Southern Canada Power Company, Ltd.	14			26,300	Nov. 10	125,319,394		14,300									
15	Kaministiquia Power Company, Ltd	15	23,300		21,600	Nov.28	104,071,000		11,880		26,700	(*p*)	26,000					
	383,128,587		43,700		91,500		90,000	Dec. 15	350,024,224		65,068		84,000	Dec. 16	318,700,406		77,000	
ec. 19	382,228,176		43,630		77,400		77,000	May 26	350,695,351		40,118	(*k*)	81,500	Oct. 21	350,518,281		77,000	
	379,630,884		43,300				45,500		356,040,480		38,745	(*n*)	43,400	(*n*) Jan. 27	304,116,460	(*n*)	47,400	
	374,724,290		42,800		67,040		67,040	Dec. 6	293,010,721		32,737	(*s*)	67,180	Oct. 20	(*t*) 251,310,788		36,222	
Oct.	362,094,000		41,340		56,000			Dec.	263,299,360		30,000		39,250	Dec.	199,847,650		33,100	
pt. 14	355,707,000		40,600		76,300			Dec.	339,468,000		38,800		57,830	Sept.	264,399,000		53,400	
	354,762,797		40,500		74,800		65,000	Oct. 6	321,816,370		36,800		71,800	July 2	317,772,280		56,700	
	354,047,654		40,400			(*b*)	69,870	(*o*) Dec. 15	286,218,156		32,766	(*b*)	68,270		287,165,218			
. 28	352,809,582		40,300		77,680	(*c*)	69,100	Dec. 1	326,148,706		37,232		72,070	Dec. 21	296,678,980		62,069	
Dec.	352,253,000		40,200		47,990			Aug.	266,320,000		30,400		38,555	Aug.	198,959,000		48,238	
	328,712,384		37,500															
Oct.	319,842,000		36,500		66,000			Dec.	222,927,000	(*X*)	32,100		65,000	Dec.	252,735,540		56,000	
t. 7	305,326,889		34,850		80,070		76,790	Dec. 18	334,518,201		38,187		74,800	Dec. 8	262,971,086			
ec. 6	301,548,168		34,400				74,600	(*n*) Dec. 21	278,626,089		31,750		65,000	Nov. 18	247,311,779		53,500	
Dec.	289,073,000		33,000		41,692			Oct.	200,750,534		22,900		35,919	Dec.	224,109,866		37,749	
	285,892,553		32,600		67,080		66,000	Dec. 14	268,618,910		30,700		58,645	Dec. 22	244,055,341		55,000	
13	279,334,470		31,900		50,200			June 30-July 1&2	273,230,332		31,191		49,900	July 16	260,300,140		40,500	June
. 9	277,591,025		31,690		64,800		60,000	Dec. 14	232,848,275		26,581		59,600	Dec. 29	218,245,950		50,800	
)	275,376,599		31,400		62,000		60,000	Dec. 7	258,765,399		29,500							
ec.8	271,701,688		31,000						150,060,345		24,666	(*q*)	33,084	(*q*) Aug. 22	252,186,398	(*q*)	30,297	(*q*)
. 30	271,440,543		30,990				44,750	Dec. 8	227,490,211		25,969		32,796	Dec. 22	170,852,661		28,800	
. 23	266,235,456		30,400		58,000	(*c*)	55,100	Dec. 21	261,690,006		29,800							
g. 31	262,409,515		29,950		62,280		62,000	Nov. 23	214,669,321		24,730	(*u*)	59,260	Jan. 1	178,047,098		41,200	
25	260,726,212		29,760		69,540		68,000	June 23	257,540,000		29,400		52,040	Nov. 4	204,811,841		38,910	
Dec.	255,766,000		29,200		44,400			Dec.	237,403,000		27,100		39,300	Dec.	196,911,791	(*B*)	34,500	
. 8	254,843,000		29,100															
	250,542,000		28,600		34,000			Dec.	122,937,000		14,000							
. 21	247,191,413		28,200		68,200		68,200	Dec. 23	213,459,806		24,361		58,300	Dec. 17	184,683,171		69,000	
	241,723,000		27,600															
15	237,512,000		27,100		54,020			Nov. 22	214,065,156		18,371		46,300	Aug. 6	197,864,432	(*n*)	39,800	
20	(*P*) 237,227,562		27,050		57,800			Nov. 4	(*P*) 243,812,849	(*P*)	27,850							
	234,238,160		26,750						222,310,255		25,350		56,250	Dec. 8	217,377,479		48,700	
	226,892,235		25,900		62,500		62,450	Nov. 30	227,630,419		25,668		46,300	Dec. 14	208,994,394		40,100	
	222,132,700		25,350		31,000		30,600	Nov.	115,535,700		26,000							
Dec.	221,118,000		25,200		44,400			Dec.	194,417,500		22,200		35,800	Dec.	177,590,200		35,200	
c. 16	220,727,440		25,175			(*c*)	43,800	(*o*) Dec. 17	183,268,485		20,921	(*q*)	628,410	Dec. 30	174,943,577	(*o*)	33,300	
17	220,324,000		25,100		67,000	(*Y*)	67,000	Aug. 26	192,253,000		26,000		56,400	May 1	190,355,000		54,700	
n. 12	214,167,000		24,450		64,000			Feb.	173,623,725		19,900							
. 7	213,752,872		24,400		43,000		42,000	Aug. 20	165,088,310		19,400							
c. 15	212,368,156		24,240															
24	206,356,017		23,550		24,750			Sept. 3	113,107,669		(*e*)							
c. 21	201,094,000		22,950		38,800			Sept. 22	187,052,800		21,350		30,500	Oct.	177,233,500		34,700	
30	197,580,149		22,500		55,000		40,300	Oct. 11	195,791,000		22,000		33,000	Dec. 29	157,662,360		33,400	
c. 20	195,180,800		22,300		33,366				176,135,500		20,100							
. 5	185,904,592		21,200	(*i*)	34,100	(*i*)	34,100	(*i*) Dec. 21	146,560,259		16,700							
	183,843,000		21,000		43,500			Dec.	151,908,790		17,300							
19	174,146,677		19,900						164,932,820		18,800	(*n*)	31,000	Dec. 21	151,475,140			
.4	173,617,378		19,800		52,600		50,000	Dec. 20	172,222,651		19,860		50,300	Dec. 1	155,470,639		48,800	
c. 23	171,925,970		19,620		35,100			Nov.	159,430,750		18,200		36,400	Dec.	144,739,433		31,700	
Dec.	171,611,000		19,590		27,677			Dec.	166,214,470		19,000	(*i*)	35,000	Aug.	155,585,707			
. 8	168,960,000		19,280		10,000			April 13	137,256,705		4,679							
Dec.	166,244,000		18,980		36,392			Dec.	137,786,000		15,700		34,300	Dec.	121,627,000		31,700	
ec. 7	165,318,271		18,870			(*b*)	51,792	(*o*) Nov. 30	153,976,958		17,577		48,000	Dec. 21	138,876,293	(*o*)	41,440	
. 3	157,892,000		18,000		29,000			Sept. 4	106,141,300		12,111							
20	155,783,691		17,780	(*i*)	22,000		20,000	(*l*) Dec. 2	100,344,073		11,455							
	153,364,676		17,500			(*c*)	33,200	(*o*) Nov. 17	150,635,115		29,067		30,400	Dec. 4	(*w*) 128,835,193		35,000	
	143,260,369		16,350															
April	140,230,159		16,000		51,500			Dec.	155,794,457		17,800		51,500	Dec.	183,622,525		50,000	
ay 19	135,474,100		15,470			(*c*)	28,850		125,911,263		14,373	(*x*)	30,300	(*y*)	118,617,000	(*B*)	26,400	
. 8	135,199,859		15,440															
15	(*R*) 135,692,265		15,490		28,600		27,500	Dec. 21	117,679,234		13,000		25,800	Sept. 30	106,992,465			
	134,416,934		15,340		32,000		31,000	Nov. 8	128,293,150		13,800							
30	131,861,909		15,030		32,900		31,500	Dec. 13	123,632,339		14,110							
28	131,017,494		14,950		32,530		32,000	Sept. 14	124,713,651		14,237		30,000	Dec. 4	108,316,069			
	126,801,100		14,480		31,900		31,000	Nov. 1	123,369,160		13,400		27,300	Dec. 18	117,956,180			
	120,521,353		13,760															
	116,194,720		13,260				29,740		107,971,800		12,325							
16	115,393,187		13,170		26,600			Dec. 28	100,874,562		11,515							
. 1	114,195,401		13,030				27,620	Dec. 7	100,462,550		11,468							
13	112,890,480		12,880		32,500		30,000	Dec. 13	105,039,000		11,991		38,900	Feb. 4	108,822,300			
c. 21	109,786,578		12,530		22,500			Aug. 13	111,341,210		11,263							
28	108,254,302		12,360															
16	107,715,140		12,290		31,500	(*c*)	30,000	Feb. 19 & 23	100,957,540		11,525							
20	105,634,000		12,060		23,140			Dec. 8	104,648,573		11,644							
12	102,229,660		11,670															
20	101,315,500		11,570		35,830			Jan. 18	109,818,700		12,538							
	73,607,219,200																	
1	4,133,501,842		471,900		711,220	(*M*)	704,042	Nov. 19	3,867,398,041		441,483		635,485	Dec. 8	3,298,347,874		576,403	
18	3,021,201,950		345,000		392,330		392,330	Dec. 9	2,557,613,443		292,000		371,002	Nov. 24	2,421,046,311		347,448	
	1,719,820,588		196,300															
14	1,354,895,244		154,700		252,000		252,000	Nov. 22	1,251,502,612		142,800		233,230	Dec. 9	1,175,430,654		221,060	
22	853,887,000		97,500															
	604,597,700		69,000						591,893,200		67,600							
10	511,103,200		58,400		66,200		62,200	Dec. 1	285,508,300		32,592		61,100	Jan.	252,891,600			
11	476,999,100		54,400				63,300		410,327,600		46,820							
13	358,371,100		40,900		70,844		68,144	Dec. 20	324,993,710		37,100		60,321	Dec. 31	261,996,380		46,065	
21	350,402,700		40,000		79,000		77,200	Dec. 16	333,654,900		38,088		83,100	Dec. 22	336,907,650		75,200	
22	305,415,945		34,800															
24	253,859,900		28,980		53,200		53,200	Dec. 15	241,355,956		21,105							
8	213,670,326		24,390		42,250		39,860	Dec. 2	177,990,960		20,319							
10	125,319,394		14,300															
28	104,071,000		11,880		26,700	(*p*)	26,000	Nov. 26	144,638,800		16,500		28,000	Sept. 30	107,576,036			

,860	Dec. 2	177,990,960		20,319							
,000	Nov. 26	144,638,800		16,500	28,000	Sept. 30	107,576,036				
	Dec. 11	155,922,990	37,970	May 8	136,333,990	37,450	Dec. 4	136,825,060	28,280	Dec. 16	105,593,490	48
Dec. 23	286,695,035	70,000	Dec. 27	269,870,850	70,000	Dec. 20	251,984,618	65,000	Dec. 14	238,028,571	49
Dec. 15	279,848,936	73,000	Dec. 5	273,643,372	58,000	Dec. 14	215,785,945	46,700	Dec. 13	179,121,428	50
Jan. 9	267,074,055	46,400	Dec. 10	259,720,216	43,000	Dec.	232,684,874	42,000	Oct. 12	187,249,647	51
Dec. 10	180,554,058	32,463	Nov. 20	153,500,531	27,695	Dec. 20	131,293,165	20,270	March 16	133,091,607	52
Nov. 25	161,307,120	27,400	Dec. 3	129,318,120	24,200	Nov. 22					53
Sept. 4	262,187,000	37,570	Dec. 17	225,453,000	66,560	Dec. 13	183,536,613	33,620	Sept. 22	156,861,213	54
Nov. 8	238,574,255	59,600	June 13	217,138,000	56,400	May 16	201,796,000	57,900	May 17	170,826,000	55
	227,558,428	50,900	Dec. 5	196,432,892	45,706	Dec. 14	158,371,247	28,255	Nov. 28	101,129,915	56
Dec. 12	267,223,754	61,824	Dec. 6	248,156,900	53,040	Nov. 23	193,503,573	48,734	Dec. 16	185,480,692	57
May	218,464,000	40,016	Aug.	222,590,000	38,323	July 24	212,237,000	35,635	Sept. 1	190,215,255	58
											59
Dec. 12	226,584,380	51,700	Dec.	211,765,420	46,500	Dec. 13	188,000,000				60
											61
Dec. 30	202,871,998	42,300	Sept. 5	174,670,219	30,800	Oct.	128,345,120	26,300	Dec.	114,587,986	62
Dec. 10	193,987,141	35,202	Dec. 5	162,443,207							63
Dec. 22	216,151,037			145,302,874	28,800	Dec.	102,631,000				64
June 7-Oct. 21	226,680,958	40,100	June 11	219,653,900	36,200	July 14	186,671,850	45,700	June 6 & Aug. 8	199,453,965	65
Dec. 9	152,125,000	35,600	Dec. 7	115,431,550							66
											67
q) Dec. 9	258,750,604	34,510	Oct. 19	261,577,017	32,449	Nov. 3	246,175,203	35,018	Aug. 14	258,249,673	68
Dec. 23	149,220,978										69
											70
Dec. 17	148,402,996	58,826	May	152,681,540							71
Dec. 5	156,732,805	36,310	Oct. 16	160,246,106							72
	188,771,500	30,900	Dec. 19	152,702,800	22,700	Dec. 29	120,698,840	22,190	Dec. 12	113,913,335	73
											74
											75
Nov. 5	245,047,430	43,500	Dec. 18	127,357,201							76
											77
Dec. 23	164,162,797										78
											79
Dec. 23	168,403,952	40,650	Dec. 5	143,749,060	35,300	Nov. 15	120,011,093				80
Dec. 30	165,364,793	36,100	Dec 20	147,423,930							81
											82
Dec.	163,783,700	33,000	Dec 3	160,464,200	29,600	Dec 7	139,167,200	25,000	Dec	130,479,900	83
	154,117,396	32,200	Dec 3	146,136,310	32,500	Dec 11	128,445,449				84
Nov. 19	163,178,438	60,200	Oct 23 / Nov 22	181,202,880	56,000	Dec 14	134,000,000	31,700	Nov 14	97,754,000	85
											86
											87
											88
											89
Dec 18	166,110,700	34,000	Dec 19	160,624,600	30,200	Dec 6	140,272,500	28,200	Oct 28	127,758,800	90
Dec. 19	147,218,203	29,600	Dec 7	136,757,822	31,900	Dec 5	112,546,832	28,400	Dec 20	95,697,600	91
											92
											93
											94
											95
Dec. 22	121,512,151	47,782	Jan 3	133,707,946	47,500	Dec 18	115,938,294	40,300	Dec 21	89,857,700	96
Dec. 22	127,924,350	16,300	Dec 3	105,400,728							97
	137,304,890	25,000	Sept	116,676,395							98
											99
Dec. 22	112,743,000										100
Dec. 18	124,813,962	40,060	Dec 10	126,621,397	38,030	Dec 20	110,225,488				101
											102
											103
Dec.	113,239,516										104
											105
Dec. 31	257,757,000	45,067	Dec 18	240,662,700	38,500	Dec 21	178,790,374	29,500	Oct 15	163,286,500	106
Dec. 10	107,440,900	24,600	Nov 27	100,205,700							107
											108
											109
											110
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Dec. 22	3,026,615,156	520,084	Nov. 27	2,906,519,819	46,471	Dec. 13	2,392,092,267				1
Nov. 7	2,066,066,762	272,500	Nov. 7	1,667,397,876	250,000	Dec. 19	1,383,390,773	160,500	Dec. 19	863,124,240	2
											3
Dec. 24	1,157,648,660	197,565	Nov. 8	1,089,099,507	185,500	Nov. 27	945,206,656	165,900	Nov. 16	907,237,573	4
											5
											6
											7
											8
Oct. 28	200,520,080	39,835	Nov. 20	164,609,860	38,048	Dec. 11	144,509,000	34,264	Nov. 23	125,124,855	9
Dec. 9	300,456,350	32,700	Dec. 29	129,548,600				27,200	March 1	122,684,800	10
											11
											12
											13
											14
											15

100	Memphis Power & Light Company	100	(A) 46,000			(A) Dec.	166,244,000	18,980	36,392		
101	Blackstone Valley Gas & Electric Company	101		(c)	52,200	(o) Dec. 7	165,318,271	18,870		(b)	51,792
102	Atlantic City Electric Company	102	36,000			Sept. 3	157,892,000	18,000	29,000		
103	Gulf States Utilities Company	103	29,754		27,500	July 20	155,783,691	17,780	(i) 22,000		20,000
104	Wisconsin Public Service Corporation	104					153,364,676	17,500		(c)	33,200
105	Central Georgia Power Company	105			42,120		143,260,369	16,350			
106	Fort Worth Power & Light Company	106	(A) 48,500			(A) April	140,230,159	16,000	51,500		
107	Edison Electric Company of Lancaster, Pa.	107	(A) 30,200			(A) May 19	135,474,100	15,470		(c)	28,850
108	Public Service Company of Oklahoma	108	(i) 39,222		35,300	Dec. 8	135,199,859	15,440			
109	Central Illinois Light Company	109	31,727		92,500	Dec. 15	(R) 135,692,265	15,490	28,600		27,500
110	Des Moines Electric Light Company	110	40,000		36,400		134,416,934	15,340	32,000		31,000
111	Indiana Service Corporation	111	34,000		34,000	Nov. 30	131,861,909	15,030	32,900		31,500
112	Moline-Rock Island Mfg. Company	112	31,570		31,000	Nov. 28	131,017,494	14,950	32,530		32,000
113	San Diego Consolidated Gas & Electric Company	113					126,801,100	14,480	31,900		31,000
114	Central Power & Light Company	114			25,205		120,521,353	13,760			
115	Cumberland County Power & Light Company	115			30,580		116,194,720	13,260			29,740
116	Salem Electric Lighting Company	116	27,000		27,000	Dec. 16	115,393,187	13,170	26,600		
117	Tampa Electric Company and Subsidiaries	117	25,340			Jan. 1	114,195,401	13,030			27,620
118	The Worcester Electric Light Company	118	35,000		34,500	Dec. 13	112,890,480	12,880	32,500		30,000
119	Delaware Electric Power Company*	119		(o)	25,000	(o) Dec. 21	109,786,578	12,530	22,500		
120	Fall River Electric Light Company	120	30,500			Nov. 28	108,254,302	12,360			
121	The Staten Island Edison Corporation	121	29,000	(c)	25,600	Feb. 16	107,715,140	12,290	31,500	(c)	30,000
122	Indiana General Service Company	122	24,600			Nov. 20	105,634,000	12,060	23,140		
123	Augusta-Aiken Railway & Electric Corporation	123	19,200		19,200	Dec. 12	102,229,660	11,670			
124	United Electric Light Company (Springfield, Mass.)	124	36,800		36,800	Sept. 20	101,315,500	11,570	35,830		
	Total (C)						73,607,219,200				
	Canada										
1	Hydro-Electric Power Commission of Ontario	1	746,275	(M)	740,530	Dec. 1	4,133,501,842	471,900	711,220	(M)	704,042
2	Shawinigan Water & Power Company	2	420,300		420,300	Oct. 18	3,021,201,950	345,000	392,330		392,330
3	Duke-Price Power Company, Ltd.	3					1,719,820,588	196,300			
4	Montreal Light, Heat & Power Consolidated	4	256,760		254,000	Dec. 14	1,354,895,244	154,700	252,000		252,000
5	Laurentide Power Company, Ltd.	5	126,000		126,000	June 22	853,887,000	97,500			
6	Canadian Niagara Power Company, Ltd.	6					604,597,700	69,000			
7	Winnipeg Electric Company (J)	7	112,000		107,500	Nov. 10	511,103,200	58,400	66,200		62,200
8	West Kootenay Power & Light Company, Ltd.	8			65,600	Aug. 11	476,999,100	54,400			63,300
9	City of Winnipeg Hydro-Electric System	9	75,834		72,100	Dec. 13	358,371,100	40,900	70,844		68,144
10	British Columbia Electric Ry. Co., Ltd. (Mainland System)	10	(p) 87,400	(c)	86,600	Dec. 21	350,402,700	40,000	79,000		77,200
11	Canada Northern Power Corporation, Ltd. System	11	43,690		34,850	Dec. 22	305,415,945	34,800			
12	Dominion Power & Transmission Company, Ltd.	12	56,300		53,000	Nov. 24	253,859,900	28,980	53,200		53,200
13	Ottawa & Hull Power Company (H)	13	45,100			Nov.8	213,670,326	24,390	42,250		39,860
14	Southern Canada Power Company, Ltd.	14			26,300	Nov. 10	125,319,394	14,300			
15	Kaministiquia Power Company, Ltd	15	23,300		21,600	Nov.28	104,071,000	11,880	26,700	(p)	26,000
	Total						14,387,116,989				
	Mexico										
1	The Mexican Light & Power Company, Ltd. and Subsidiaries	1		(c)	102,386	(o) Nov.	606,245,844	69,200			99,644
2	Cia. Agricola y de Fuerza Electrica del Rio Conchos	2	(o) 22,700			(o) Feb. 26	156,086,800	17,820			
	Total						762,332,644				
	Electric Railways										
1	Interborough Rapid Transit Company	1		(a)	284,660	(n) Jan.27	1,103,063,438	125,900			283,600
2	Chicago Surface Lines	2	300,660			Jan. 3	(r) 577,710,827	(r) 71,900	264,000	(c)	198,463
3	Williamsburgh Power Plant Corporation (B.M.T.)	3	(o) 138,200		142,000	Dec. 9	544,081,653	62,100	(o) 138,100		142,000
4	Philadelphia Rapid Transit Company	4			120,318	(n) Jan. 11	371,731,556	42,400			120,290
5	The Pennsylvania Railroad (L. I. City Gen. Sta.)	5	(B) 99,600	(o)	87,000	(B) Dec. 9	307,432,390	35,100	(B) 88,800		
6	Boston Elevated Railway	6	(Q) 94,457	(Q)	90,164	Jan. 26	(Q) 243,925,965	(Q) 27,800	94,490		90,195
7	New York Central Railroad Company	7	(i) 75,000	(c)	69,360		222,131,354	25,400	73,000	(b)	63,680
8	Pacific Electric Railway Company	8	54,000		47,000	Apr. 6	190,485,000	21,750	52,000		46,000
9	New York, New Haven & Hartford Railroad Company	9	50,500		40,900	Nov. 23	189,691,700	21,650	(G) 43,000	(G,c)	32,700
10	Chicago, Milwaukee & St. Paul Railway	10					(Z) 148,560,111	(Z) 16,950			
11	Twin City Rapid Transit Company	11		(o)	45,333	Dec. 6	137,695,684	15,720			48,428
12	Kansas City Public Service Company	12	44,000		41,000	Jan. 14	128,913,861	14,720	45,000		42,600
13	Norfolk & Western Railway Company	13					123,759,732	14,100	38,500		27,000
14	The Connecticut Company	14		(b)	26,925		114,168,609	13,030		(b)	25,450
	Total						4,403,351,880				

*Because of absorptions and consolidations, and to avoid duplication of statistics, certain companies separately listed last year have now disappeared as shown in the following table:

Present Company	*Includes*
Columbia Gas & Electric Corp. System (23)	Columbia Power Co. Dayton Power & Light Co. Union Gas & Electric Co.
Delaware Electric Power Co. (119)	Formerly Wilmington & Philadelphia Traction Co.
Duke Power Co. (9)	Formerly Southern Power Co. with absorptions of certain other properties.
Edison United & Allied Companies (3)	New York & Queens Elec. Lt. & Pwr. Co. Westchester Lighting Co.
Indianapolis Power & Light Co. (59)	Indianapolis Light & Heat Co. Merchants Heat & Light Co.
Louisiana Power & Light Co. (75)	Louisiana Power Co.
New England Power Association & Subs. (19)	New England Power System. Narragansett Elec. Lighting Co.
Pacific Gas & Electric Co. (5)	Western States Gas & Electric Co. (Stockton, Richmond & Eureka), also Coast Valleys Gas & Electric Co.
Pennsylvania Group of Associated Gas & Electric System (43)	Penn Public System.
Texas Power & Light Co. (54)	Oil Belt Power Co.
Western Power Corp. Subs.(14)	North Americ Properties S Great Western San Joaquin Corp.

(a) Actual over thirty-minute period.
(b) Actual over one-hour period.
(c) Estimated over one-hour period.
(d) Includes 12,500 kw. joint operation with Edison Co.
(e) Average load 9,111 kw. for five plants, 14,004 kw. for six plants, eight months.
(f) Includes 24,239,872 kw.-hr. joint operation wealth Edison Co.
(g) Average of monthly maximum demands.

	Dec.	137,786,000	15,700		34,300	Dec.	121,627,000		31,700	Dec. 22	112,743,000			
,792	(o) Nov. 30	153,976,958	17,577		48,000	Dec. 21	138,876,293	(o)	41,440	Dec. 18	124,813,962	40,060	Dec 10	12
	Sept. 4	106,141,300	12,111											
,000	(l) Dec. 2	100,344,073	11,455											
,200	(o) Nov. 17	150,635,115	29,067		30,400	Dec. 4	(w) 128,835,193		35,000	Dec.	113,239,516			
	Dec.	155,794,457	17,800		51,500	Dec.	183,622,525		50,000	Dec. 31	257,757,000	45,067	Dec 18	24
,850		125,911,263	14,373	(x)	30,300	(y)	118,617,000	(B)	26,400	Dec. 10	107,440,900	24,600	Nov 27	10
,500	Dec. 21	117,679,234	13,000		25,800	Sept. 30	106,992,465							
,000	Nov. 8	128,293,150	13,800											
,500	Dec. 13	123,632,339	14,110											
,000	Sept. 14	124,713,651	14,237		30,000	Dec. 4	108,316,069							
,000	Nov. 1	123,369,160	13,400		27,300	Dec. 18	117,956,180							
,740		107,971,800	12,325											
	Dec. 28	100,874,562	11,515											
,620	Dec. 7	100,462,550	11,468											
,000	Dec. 13	105,039,000	11,991		38,900	Feb. 4	108,822,300							
	Aug. 13	111,341,210	11,263											
,000	Feb. 19 & 23	100,957,540	11,525											
	Dec. 8	104,648,573	11,644											
	Jan. 18	109,818,700	12,538											
,042	Nov. 19	3,867,398,041	441,483		635,485	Dec. 8	3,298,347,874		576,403	Dec. 22	3,026,615,156	520,084	Nov. 27	2,90
,330	Dec. 9	2,557,613,443	292,000		371,002	Nov. 24	2,421,046,311		347,448	Nov. 7	2,066,066,762	272,500	Nov. 7	1,66
,000	Nov. 22	1,251,502,612	142,800		233,230	Dec. 9	1,175,430,654		221,060	Dec. 24	1,157,648,660	197,565	Nov. 8	1,08
		591,893,200	67,600											
,200	Dec. 1	285,508,300	32,592		61,100	Jan.	252,891,600							
,300		410,327,600	46,820											
,144	Dec. 20	324,993,710	37,100		60,321	Dec. 31	261,996,380		46,065	Oct. 28	200,520,080	39,835	Nov. 20	16
,200	Dec. 16	333,654,900	38,088		83,100	Dec. 22	336,907,650		75,200	Dec. 9	300,456,350	32,700	Dec. 29	12
,200	Dec. 15	241,355,956	21,105											
,860	Dec. 2	177,990,960	20,319											
,000	Nov. 26	144,638,800	16,500		28,000	Sept. 30	107,576,036							
,644		594,046,265	67,748	(n)	98,991		561,425,403							
,600	Jan. 28	1,063,717,242	121,224	(n)	276,380	Jan. 23	1,063,504,660	(n)	272,760	Jan. 26	1,019,620,637	254,850	Mar. 29	96
,463	Dec. 14	(r) 581,706,072	(r) 72,666	(i)	200,000	Feb. 27	630,560,494	(o)	185,866	Dec. 23	604,581,618	170,485	Dec. 13	57
,000	Jan. 29	542,141,625	61,888	(o)	132,300	Dec. 23	508,481,425	(o)	132,200	Dec. 26	478,911,990	126,200	Jan. 17	44
,290	Jan. 28	390,915,742	44,625	(n)	116,160	Jan. 28	385,707,158	(n)	120,885	Jan. 21	371,519,687	115,154	Jan. 17	38
		286,533,764	(G) 27,350		98,000	Jan. 2	266,137,403		96,300	Dec. 26	244,345,733	70,600	Feb. 15	24
,195	Jan. 29	257,696,595	29,417		94,226	Jan. 28	247,490,105		94,869	Jan. 21	261,091,060	82,965	Dec. 19	25
,680	Dec. 27	205,649,608	22,800	(i)	70,000	Dec. 28	184,775,459		62,500	Dec. 24	173,938,625	47,120	Jan. 25	16
,000	Dec. 22	187,975,148	21,460	(o)	44,000	Dec. 15	183,000,000		50,000	April 3	185,000,000	43,000	Dec. 21	19
,700	Dec. 16	209,658,870	(G) 14,594		40,000	Dec. 10	209,542,400							
		(Z) 138,083,293					136,993,694				(i) 116,974,186			12
,428	(n) Jan. 19	140,216,985	16,007	(n)	24,460		144,413,357				143,000,000	51,218	Feb. 13	14
,600	Dec. 15	131,186,730	14,976		43,000	Jan. 27-Dec. 22	127,740,470		43,000	Dec. 18	129,383,860	42,600	Feb. 14	12
,000	Oct. 30	106,426,752	12,263											
,450	(o) Feb. 10	115,769,700	13,200											

Includes
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(h) Estimated over fifteen-minute period.
(i) Estimated.
(k) Kva.
(l) For Texas Division.
(m) Over fifteen-minute period.
(n) Over thirty-minute period.
(o) Over one-hour period.
(p) Estimated over ten-minute period.
(q) Over eight-hour period
(r) Output measured on dc. side, average load on a.c. side.
(s) Includes Keno plant, operated under lease.
(t) Includes 214,560 kw.-hr. not billed to the company.
(u) Includes Ozark Power & Water Co.
(v) Maximum daily kilowatt-hour.
(w) At busbar.

(x) Over five-minute period, 25-cycle system 12,500 kw.; 60-cycle system 17,800 kw.
(y) 25-cycle system Dec. 2; 60-cycle system Dec. 9.
(A) Duration of peak not specified.
(B) Over five-minute period.
(C) Includes Canadian Niagara Power Co., Ltd. (See Canada).
(D) Includes 11,000 kw. joint operation with Commonwealth Edison Co.
(E) Includes 50,961,607 kw.-hr. joint generation with Commonwealth Edison Co.
(F) Maximum machine demand.
(G) On generating plant only.
(H) Includes Ottawa River Power Co.
(I) Includes the Western Maine Power Co. System which was operated as part of the Central Maine Power Co. System during 1927.

(J) Includes Manitoba P
(K) Figures prior to 1926 Co. only.
(L) Not comparable with
(M) Actual over twenty-n
(N) 25 cycle, 18,300 inst 60 cycle, 49,000 inst
(O) Statistics of Louisian Power Co. for previo
(P) On same method o between districts as 225,812,630 kw.-hr.
(Q) Converted a.c. meas
(R) Reported as 134,692, items in Table II.

c.	166,244,000	18,980	36,392		Dec.	137,786,000	15,700	34,300	Dec.	121,627,000			D
. 7	165,318,271	18,870		(b) 51,792	(o) Nov. 30	153,976,958	17,577	48,000	Dec. 21	138,876,293	(o) 41,440		D
3	157,892,000	18,000	29,000		Sept. 4	106,141,300	12,111						
0	155,783,691	17,780	(i) 22,000	20,000	(l) Dec. 2	100,344,073	11,455						
	153,364,676	17,500		(c) 33,200	(o) Nov. 17	150,635,115	29,067	30,400	Dec. 4	(w) 128,835,193	35,000		
	143,260,369	16,350											
ril	140,230,159	16,000	51,500		Dec.	155,794,457	17,800	51,500	Dec.	183,622,525	50,000		D
19	135,474,100	15,470		(c) 28,850		125,911,263	14,373	(x) 30,300	(y)	118,617,000	(B) 26,400		D
8	135,199,859	15,440											
5	(R) 135,692,265	15,490	28,600	27,500	Dec. 21	117,679,234	13,000	25,800	Sept. 30	106,992,465			
	134,416,934	15,340	32,000	31,000	Nov. 8	128,293,150	13,800						
30	131,861,909	15,030	32,900	31,500	Dec. 13	123,632,339	14,110						
28	131,017,494	14,950	32,530	32,000	Sept. 14	124,713,651	14,237	30,000	Dec. 4	108,316,069			
	126,801,100	14,480	31,900	31,000	Nov. 1	123,369,160	13,400	27,300	Dec. 18	117,956,180			
	120,521,353	13,760											
	116,194,720	13,260		29,740		107,971,800	12,325						
6	115,393,187	13,170	26,600		Dec. 28	100,874,562	11,515						
1	114,195,401	13,030		27,620	Dec. 7	100,462,550	11,468						
3	112,890,480	12,880	32,500	30,000	Dec. 13	105,039,000	11,991	38,900	Feb. 4	108,822,300			
21	109,786,578	12,530	22,500		Aug. 13	111,341,210	11,263						
28	108,254,302	12,360											
16	107,715,140	12,290	31,500	(c) 30,000	Feb. 19 & 23	100,957,540	11,525						
20	105,634,000	12,060	23,140		Dec. 8	104,648,573	11,644						
12	102,229,660	11,670											
20	101,315,500	11,570	35,830		Jan. 18	109,818,700	12,538						
	73,607,219,200												
1	4,133,501,842	471,900	711,220	(M) 704,042	Nov. 19	3,867,398,041	441,483	635,485	Dec. 8	3,298,347,874	576,403		D
8	3,021,201,950	345,000	392,330	392,330	Dec. 9	2,557,613,443	292,000	371,002	Nov. 24	2,421,046,311	347,448		N
	1,719,820,588	196,300											
14	1,354,895,244	154,700	252,000	252,000	Nov. 22	1,251,502,612	142,800	233,230	Dec. 9	1,175,430,654	221,060		D
22	853,887,000	97,500											
	604,597,700	69,000				591,893,200	67,600						
10	511,103,200	58,400	66,200	62,200	Dec. 1	285,508,300	32,592	61,100	Jan.	252,891,600			
11	476,999,100	54,400		63,300		410,327,600	46,820						
13	358,371,100	40,900	70,844	68,144	Dec. 20	324,993,710	37,100	60,321	Dec. 31	261,996,380	46,065		Oc
21	350,402,700	40,000	79,000	77,200	Dec. 16	333,654,900	38,088	83,100	Dec. 22	336,907,650	75,200		D
22	305,415,945	34,800											
24	253,859,900	28,980	53,200	53,200	Dec. 15	241,355,956	21,105						
8	213,670,326	24,390	42,250	39,860	Dec. 2	177,990,960	20,319						
10	125,319,394	14,300											
28	104,071,000	11,880	26,700	(p) 26,000	Nov. 26	144,638,800	16,500	28,000	Sept. 30	107,576,036			
	14,387,116,989												
v.	606,245,844	69,200		99,644		594,046,265	67,748	(n) 98,991		561,425,403			
. 26	156,086,800	17,820											
	762,332,644												
n.27	1,103,063,438	125,900		283,600	Jan. 28	1,063,717,242	121,224	(n) 276,380	Jan. 23	1,063,504,660	(n) 272,760		Ja
3	(r) 577,710,827	(r) 71,900	264,000	(c) 198,463	Dec. 14	(r) 581,706,072	(r) 72,666	(i) 200,000	Feb. 27	630,560,494	(o) 185,866		De
9	544,081,653	62,100	(o) 138,100	142,000	Jan. 29	542,141,625	61,888	(o) 132,300	Dec. 23	508,481,425	(o) 132,200		De
. 11	371,731,556	42,400		120,290	Jan. 28	390,915,742	44,625	(n) 116,160	Jan. 28	385,707,158	(n) 120,885		Ja
c. 9	307,432,390	35,100	(B) 88,800			286,533,764	(G) 27,350	98,000	Jan. 2	266,137,403	96,300		De
26	(Q) 243,925,965	(Q) 27,800	94,490	90,195	Jan. 29	257,696,595	29,417	94,226	Jan. 28	247,490,105	94,869		Ja
	222,131,354	25,400	73,000	(b) 63,680	Dec. 27	205,649,608	22,800	(i) 70,000	Dec. 28	184,775,459	62,500		De
6	190,485,000	21,750	52,000	46,000	Dec. 22	187,975,148	21,460	(o) 44,000	Dec. 15	183,000,000	50,000		Ap
23	189,691,700	21,650	(G) 43,000	(G,c) 32,700	Dec. 16	209,658,870	(G) 14,594	40,000	Dec. 10	209,542,400			
	(Z) 148,560,111	(Z) 16,950				(Z) 138,083,293				136,993,694			
6	137,695,684	15,720		48,428	(n) Jan. 19	140,216,985	16,007	(n) 24,460		144,413,357			
14	128,913,861	14,720	45,000	42,600	Dec. 15	131,186,730	14,976	43,000	Jan. 27-Dec. 22	127,740,470	43,000		De
	123,759,732	14,100	38,500	27,000	Oct. 30	106,426,752	12,263						
	114,168,609	13,030		(b) 25,450	(o) Feb. 10	115,769,700	13,200						
	4,403,351,880												

cludes
Light & Heat Co.
at & Light Co.
er Co.

Power System.
Elec. Lighting Co.
s Gas & Electric
on, Richmond &
so Coast Valleys
ric Co.
ystem.

Co.

Present Company	*Includes*
Western Power Corp. Subs.(14)	North American Co. (Cal. Properties Sys.)
	Great Western Power Co. of Cal.
	San Joaquin Light & Power Corp.

(a) Actual over thirty-minute period.
(b) Actual over one-hour period.
(c) Estimated over one-hour period.
(d) Includes 12,500 kw. joint operation with Commonwealth Edison Co.
(e) Average load 9,111 kw. for five plants, four months and 14,004 kw. for six plants, eight months.
(f) Includes 24,239,872 kw.-hr. joint operation with Commonwealth Edison Co.
(g) Average of monthly maximum demands.
(h) Estimated over fifteen-minute period.
(i) Estimated.
(k) Kva.
(l) For Texas Division.
(m) Over fifteen-minute period.
(n) Over thirty-minute period.
(o) Over one-hour period.
(p) Estimated over ten-minute period.
(q) Over eight-hour period
(r) Output measured on dc. side, average load on a.c. side.
(s) Includes Keno plant, operated under lease.
(t) Includes 214,560 kw.-hr. not billed to the company.
(u) Includes Ozark Power & Water Co.
(v) Maximum daily kilowatt-hour.
(w) At busbar.
(x) Over five-minute period, 25-cycle system 17,800 kw.
(y) 25-cycle system Dec. 2; 60-cycl
(A) Duration of peak not specified
(B) Over five-minute period.
(C) Includes Canadian Niagara P
(D) Includes 11,000 kw. joint op Edison Co.
(E) Includes 50,961,607 kw.-hr. jo wealth Edison Co.
(F) Maximum machine demand.
(G) On generating plant only.
(H) Includes Ottawa River Power
(I) Includes the Western Maine operated as part of the Centr during 1927.

Dec. 18	124,813,962	40,060	Dec 10	126,621,397	38,030	Dec 20	110,225,488	.....	.....	.....	101
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	102
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Dec.	113,239,516	.....	.....	.....	.....	.....	.....	.....	.....	.....	104
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	105
Dec. 31	257,757,000	45,067	Dec 18	240,662,700	38,500	Dec 21	178,790,374	29,500	Oct 15	163,286,500	106
Dec. 10	107,440,900	24,600	Nov 27	100,205,700	.....	.....	.....	.....	.....	.....	107
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Dec. 22	3,026,615,156	520,084	Nov. 27	2,906,519,819	46,471	Dec. 13	2,392,092,267	.....	.....	.....	1
Nov. 7	2,066,066,762	272,500	Nov. 7	1,667,397,876	250,000	Dec. 19	1,383,390,773	160,500	Dec. 19	863,124,240	2
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3
Dec. 24	1,157,648,660	197,565	Nov. 8	1,089,099,507	185,500	Nov. 27	945,206,656	165,900	Nov. 16	907,237,573	4
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5
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Oct. 28	200,520,080	39,835	Nov. 20	164,609,860	38,048	Dec. 11	144,509,000	34,264	Nov. 23	125,124,855	9
Dec. 9	300,456,350	32,700	Dec. 29	129,548,600	.....	.....	.....	27,200	March 1	122,684,800	10
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	11
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Jan. 26	1,019,620,637	254,850	Mar. 29	960,340,481	246,770	Jan 24	886,223,920	242,760	Dec. 30	846,487,668	1
Dec. 23	604,581,618	170,485	Dec. 13	576,457,379	.....	.....	735,246,576	.....	.....	712,683,840	2
Dec. 26	478,911,990	126,200	Jan. 17	449,827,260	118,800	Jan. 24	413,992,125	116,000	Dec. 22	383,009,325	3
Jan. 21	371,519,687	115,154	Jan. 17	383,313,078	110,446	Dec. 19	346,506,580	105,303	Dec. 22	333,222,786	4
Dec. 26	244,345,733	70,600	Feb. 15	244,113,039	72,000	Dec. 30	214,906,725	64,000	Dec. 30	201,922,210	5
Jan. 21	261,091,060	82,965	Dec. 19	257,983,320	78,755	Dec. 13	240,547,615	25,905	Jan. 18	223,061,330	6
Dec. 24	173,938,625	47,120	Jan. 25	163,895,940	48,470	Jan. 3	157,450,819	50,750	Dec. 23	149,275,239	7
April 3	185,000,000	43,000	Dec. 21	198,211,000	.....	.....	.....	.....	.....	.....	8
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	9
.....	(i) 116,974,186	.....	.....	122,643,791	.....	.....	.....	.....	.....	.....	10
.....	143,000,000	51,218	Feb. 13	146,605,919	47,005	Dec. 14	145,675,337	44,599	Feb. 8	145,517,164	11
Dec. 18	129,383,860	42,600	Feb. 14	128,302,450	40,200	Dec. 12	123,830,190	43,500	Jan. 13	129,804,772	12
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	13
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	14
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	

25-cycle system 12,500 kw.; 60-

-cycle system Dec. 9.
cified.

ra Power Co., Ltd. (See Canada).
t operation with Commonwealth

r. joint generation with Common-

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ower Co.
aine Power Co. System which was
Central Maine Power Co. System

(*J*) Includes Manitoba Power Co., Ltd.

(*K*) Figures prior to 1926, for Northern Indiana Gas & Electric Co. only.

(*L*) Not comparable with previous years because of merger.

(*M*) Actual over twenty-minute period.

(*N*) 25 cycle, 18,300 instantaneous, 18,000 half-hour May 11; 60 cycle, 49,000 instantaneous, 48,500 half-hour Dec. 19.

(*O*) Statistics of Louisiana Power & Light Co. for 1927; Louisiana Power Co. for previous year.

(*P*) On same method of accounting for energy transferred between districts as in 1927, output in 1926 would be 225,812,630 kw.-hr.

(*Q*) Converted a.c. measured on d.c. side; plus generated d.c.

(*R*) Reported as 134,692,265; changed to conform with sum of items in Table II.

(*S*) Includes Nevada-California Power Co. and Yuma Utilities Co.; prior to 1926, included Nevada-California Power Co. and Desert Water, Oil & Irrigation Co.

(*T*) Includes only the Philadelphia Electric Co. and Delaware County Electric Co.

(*U*) Operations for 1927 include Bridgeport and New Haven Divisions; 1926 figures for Bridgeport Division only.

(*V*) Includes Metropolitan Edison Co., Pennsylvania Edison Co. New Jersey Power & Light Co., and their affiliated companies.

(*W*) Includes Broad River Power Co. and South Carolina Gas & Electric Co., the figures for the latter company being for the first seven months of 1927 at which time it was sold to the Southern Power Co.

(*X*) Based on total generation including energy used by railway.

(*Y*) Plant peak 43,500 kw., Nov. 9th.

(*Z*) Energy consumed.

Table II—Detailed Data on Ger
All Systems Havin

Line No.	Section and System	Generator Rating, Dec. 31, 1927				Generated and Purchased Output, 1927			
		Fuel Burning Plants		Hydro Plants		Total Output, Kw.-Hr.	Generated, Kw.-Hr.	Purchased, Kw.-Hr.	
		No. of Plants	Rating of Generators, Kva.	No. of Plants	Rating of Generators, Kva.				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
	New England States								
1	New England Power Association and Subsidiaries	6	290,500	10	148,500	1,104,515,429	982,267,178	122,248,764	
2	The Edison Electric Illuminating Company of Boston	3	392,817	0	0	748,502,053	718,027,746	30,474,307	
3	Turners Falls Power & Electric Company	1	37,500	4	67,500	354,762,797	268,857,180	85,905,617	
4	The Connecticut Light & Power Company	4	108,625	2	30,600	354,047,654	319,334,234	34,713,420	
5	United Illuminating Company	3	60,000	0	0	222,132,700	222,129,700	3,000	(b)
6	Central Maine Power Company (p)	2	16,875	23	72,930	220,727,440	217,220,750	3,506,690	
7	Hartford Electric Light Company	2	95,000	1	2,250	220,324,000	157,383,000	62,941,000	
8	New Bedford Gas & Edison Light Company	1	115,000	0	0	173,617,378	173,617,378	0	(b)
9	Blackstone Valley Gas & Electric Company	2	(a) 36,650	3	(a) 1,750	165,318,271	46,847,643	118,470,628	
10	Cumberland County Power & Light Company	1	28,125	5	26,500	116,194,720	99,713,920	16,480,800	
11	Salem Electric Lighting Company	1	34,375	0	0	115,393,187	115,378,600	14,587	
12	The Worcester Electric Light Company	1	70,425	0	0	112,890,480	101,112,400	11,778,080	
13	Fall River Electric Light Company	1	17,812	0	0	108,254,302	948,000	107,306,302	
14	United Electric Light Company (Springfield, Mass.)	1	55,000	2	3,050	101,315,500	61,648,500	39,667,000	
	Totals for section	29	1,365,254	50	353,390	4,117,996,424	3,484,486,229	633,510,195	
	Middle Atlantic States								
15	Buffalo, Niagara & Eastern Power Corporation System (w)	2	(a) 180,000	8	(a) 550,000	4,634,341,084	3,642,781,815	991,559,269	
16	Edison-United and Allied Companies	12	(a) 972,225	0	0	2,877,090,621	2,877,038,921	51,700	(i)
17	The Philadelphia Electric Company System (x)	6	(a) 596,750	0	0	1,860,613,091	1,859,508,620	1,104,471	
18	The West Penn Electric Company	22	(a) 459,300	9	(a) 55,655	1,727,565,353	1,709,325,745	18,239,608	
19	Public Service Electric & Gas Company (N. J.)	10	(a) 624,432	0	0	1,701,886,359	1,563,285,739	138,600,620	(b)
20	Duquesne Light Company	3	384,000	0	0	1,328,526,578	1,250,958,502	77,568,076	
21	Mohawk Hudson Power Corporation System	4	177,550	22	195,110	1,249,808,094	631,474,357	618,333,737	
22	Brooklyn Edison Company, Inc	3	482,150	0	0	957,946,741	957,940,641	6,100	
23	Pennsylvania Power & Light Company	8	(a) 206,130	3	(a) 40,450	908,579,200	606,186,500	302,392,700	
24	Pennsylvania-New Jersey Power System (C)	6	220,719	11	21,960	782,173,960	551,396,458	230,777,502	
25	Pennsylvania Water & Power Company	1	25,000	1	119,750	634,248,100	634,248,100	0	
26	Pennsylvania Group of Associated Gas & Electric System	6	110,550	2	48,000	413,209,393	408,502,830	4,706,563	
27	Northern New York Utilities, Inc	2	6,350	18	105,120	411,462,360	386,421,840	25,040,520	(b)
28	Rochester Gas & Electric Corporation	4	(a) 72,095	6	(a) 46,530	352,809,582	292,217,256	60,592,326	
29	Scranton Electric Company	4	(a) 108,000	0	0	237,512,000	232,078,000	5,434,000	
30	Penn Central Light & Power Company	2	91,750	2	5,125	226,892,235	224,005,750	2,886,485	
31	Central Hudson Gas & Electric Corporation	4	21,870	6	29,626	212,368,156	126,418,000	85,950,156	
32	East Penn Electric Company	3	(a) 40,850	0	0	195,180,800	172,316,900	22,863,900	
33	Atlantic City Electric Company	6	(a) 40,412	0	0	157,892,000	127,442,000	30,450,000	
34	Edison Electric Company of Lancaster, Pa	1	(a) 7,000	2	(a) 300	135,474,100	0	135,474,100	
35	Delaware Electric Power Company	2	31,250	0	0	109,786,578	98,141,260	11,645,318	
36	The Staten Island Edison Corporation	1	63,125	0	0	107,715,140	107,628,140	87,000	
	Totals for section (w)	112	5,022,164	90	1,339,691	21,223,081,525	18,459,317,374	2,763,764,151	
	South Atlantic States								
37	Duke Power Company	7	244,313	38	658,082	1,745,776,428	1,738,266,328	7,510,100	
38	Appalachian Electric Power Company	9	(a) 297,400	4	(a) 33,066	1,095,378,000	1,058,809,000	36,569,000	
39	Consolidated Gas Elec. Lt. & Pwr. Co. of Baltimore	3	(a) 221,000	1	(a) 600	786,877,691	407,921,190	378,956,501	
40	Carolina Power & Light Company	5	(a) 84,710	12	(a) 36,300	426,426,000	295,239,000	131,187,000	
41	Virginia Electric & Power Company	8	(a) 133,220	9	(a) 29,010	409,680,096	403,785,396	5,894,700	
42	Potomac Electric Power Company	1	150,222	0	0	383,128,587	383,127,090	1,497	(b)
43	South Carolina System (I)	2	60,000	3	26,569	266,235,456	234,320,644	32,014,812	
44	Columbus Electric & Power Company and Subsidiary	(L) 17	(a) 13,373	10	(a) 63,150	260,726,212	258,596,137	2,130,075	
45	Florida Power & Light Company	31	(a) 138,031	0	0	214,167,000	213,290,000	877,000	
46	Central Georgia Power Company	0	0	1	18,000	143,260,369	47,216,400	96,043,969	
47	Tampa Electric Company and Subsidiaries	5	(a) 37,075	1	(a) 600	114,195,401	113,157,131	1,038,270	
48	Augusta-Aiken Railway & Electric Corporation	1	1,100	2	25,775	102,229,660	70,183,660	32,046,000	(b)
	Totals for section	89	1,543,635	81	919,826	5,948,080,900	5,223,811,976	724,268,924	
	East North Central States								
49	Commonwealth Edison Company	6	(a) 1,004,500	0	0	3,778,380,000	3,575,456,000	202,924,000	
50	The Detroit Edison Company	4	(a) 633,000	9	(a) 9,160	2,142,549,100	2,141,046,200	1,502,900	
51	The Cleveland Electric Illuminating Company	4	(a) 371,350	0	0	1,138,838,831	1,138,543,141	295,690	
52	The Ohio Power Company								

enerator Rating, Output, Customers and Distributio
ng an Output Over 100,000,000 Kw.-Hr. During 192

	Distribution of Energy in Kilowatt-Hours, 1927									Nu	
	Sold to Residential Customers (10)	Sold to Commercial Lighting Customers (vv) (11)	Sold to Municipalities (ww) (12)	Sold to Power Customers (vv) (13)	Other Sales (Heating, Etc.) (14)	Sold to Electric Railways (15)	Sold to Other Public Utilities (16)	Intra-Company Business (17)	Transmission Conversion, Distribution and Other Losses (18)	Residential (19)	Commercial Lighting (20)
4	42,739,877	79,477,428	17,008,496	400,600,923	(R) 57,294,612	44,908,605	297,454,573	13,303,433	151,729,997	131,417	54,73
7	98,562,960	163,748,258	21,637,066	243,799,354	0	4,377,910	(m) 74,484,137	2,752,311	139,140,057	(n) 251,268	(n) 46,66
7	0	0	21,247,060	112,297,404	0	28,546,440	155,254,914	1,355,584	36,081,395	0	
0	29,422,192	21,199,669	5,551,301	184,301,654	0	19,925,153	(o) 33,145,028	6,697,105	53,805,552	77,017	12,38
0	(b) 78,194,812	(c)	.....	110,474,097	.....	.....	3,944,910	.....	39,518,851	(j) 105,425	(c)
0	13,096,380	11,993,538	6,244,599	101,071,034	6,041,310	(q) 28,372,964	(r)	12,733,215	41,174,400	49,371	9,79
0	21,528,000	34,334,000	(d) 3,600,000	59,421,000	0	6,486,000	75,123,000	(g)	(k) 19,832,000	54,863	9,25
0	(b) 15,050,365	(c)	2,368,442	(e) 122,173,419	(f)	657,797	18,167,291	1,299,843	13,900,221	(b) 38,360	(c)
8	9,921,847	8,815,418	3,058,615	110,350,244	0	0	15,197,827	429,077	17,545,243	36,478	6,17
0	11,934,369	12,624,501	3,858,228	33,793,336	0	14,272,969	15,762,670	.....	23,948,647	36,755	5,67
7	2,386,579	2,757,806	881,299	31,034,418	57,971	5,667,800	65,915,000	233,435	6,458,879	8,609	1,96
0	15,279,816	17,995,611	1,566,560	53,148,367	.....	.....	136,281	.....	(u) 24,763,845	46,614	6,82
2	5,244,758	6,686,316	2,871,107	76,965,354	0	0	5,924,456	.....	10,562,311	27,582	4,82
0	14,266,185	14,645,759	6,987,437	43,937,454	0	1,917,147	6,138,000	2,635,377	10,828,141	39,076	7,56
5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
9	152,154,721	256,409,212	76,204,325	2,955,461,052	14,404,131	187,698,725	608,382,252	.....	383,626,666	211,667	37,83
0	(s) 1,968,688,525	(c)	104,908,877	(c)	(c)	238,667,027	7,870,100	31,228,049	525,728,043	(j) 1 225,776	(c)
1	152,056,338	226,251,325	55,695,473	685,167,949	0	(k) 392,104,983	151,734,615	.....	197,602,408	389,920	84,16
8	81,199,957	82,281,430	22,979,691	1,133,187,114	0	88,101,795	103,450,184	(g)	(h) 216,365,182	189,230	37,71
0	(b) 413,246,455	(c)	49,981,550	717,427,571	0	232,183,864	8,935,000	11,002,769	269,109,150	(l, b) 747,631	(c)
6	144,616,775	98,893,682	26,148,735	638,632,739	16,912,450	224,879,575	623,648	69,121,691	108,697,283	239,715	29,39
7	76,455,690	69,548,621	43,867,267	534,422,488	3,905,663	(y) 95,078,414	(z) 166,222,520	(A) 66,090,891	194,216,540	234,257	32,86
0	202,439,183	169,851,412	33,424,584	344,874,412	0	3,482,200	563,900	(B) 57,740,497	145,570,553	(l) 631,621	(l) 97,28
0	47,406,463	45,900,944	22,728,956	602,112,930	0	63,207,005	47,309,573	.....	79,913,329	143,422	25,21
2	27,555,967	34,900,404	(D)	(e) 287,698,820	(f)	35,797,607	(E) 262,398,932	35,080,719	98,741,511	96,488	19,90
0	0	0	0	0	0	0	572,405,600	.....	61,842,500	0	
3	28,242,949	25,061,038	5,386,045	264,437,023	62,888	13,017,418	6,596,435	.....	70,405,517	84,101	13,23
0	(b) 11,985,075	(c)	1,889,554	213,648,725	1,280,348	12,480	145,919,334	1,100,570	35,626,274	(b) 23,844	(c)
6	38,628,444	(F) 172,416,563	15,425,336	(G)	0	41,585,762	8,623,104	17,705,066	58,425,307	88,296	(F) 11,00
0	.....	.....	.....	.....	.....	.....	.....	.....	.....	59,876	8,39
5	17,975,621	10,810,823	2,539,235	110,550,692	17,255	17,866,241	21,987,851	15,585,605	29,558,912	40,019	5,29
6	9,758,597	13,062,100	8,812,570	58,172,946	0	2,877,490	85,834,469	4,690,584	29,159,400	33,456	9,83
0	5,647,106	5,579,922	2,832,004	79,275,880	0	0	79,748,135	.....	22,097,753	21,123	4,49
0	.....	.....	.....	.....	.....	.....	.....	.....	.....	56,060	10,10
0	10,214,617	12,889,984	8,789,854	63,749,310	2,426,000	26,016	1,377,440	.....	36,000,879	32,603	5,05
8	8,284,175	8,179,356	1,290,769	49,595,062	0	0	15,748,394	15,575,349	11,111,473	23,033	4,93
0	9,947,845	4,647,952	8,873,806	50,082,657	0	22,716,781	0	583,307	10,862,792	30,570	4,70
1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
0	(H)	(H)	(H)	(H) 1,481,116,722	(H)	(H)	(H)	.....	264,659,706	.....	.....
0	.....	.....	.....	.....	.....	.....	.....	.....	.....	70,411	12,69
1	79,934,496	85,671,107	15,661,616	393,633,819	0	128,478,332	0	6,534,011	76,964,310	164,397	24,22
0	18,797,604	17,710,318	22,432,960	271,586,536	0	0	15,096,459	.....	80,802,123	45,567	14,54
0	27,219,736	33,632,436	9,414,754	223,946,461	6,269,415	1,990,260	12,283,450	41,895,698	53,027,886	79,431	13,64
7	(b) 137,705,126	(c)	9,634,694	(e) 68,565,568	(f)	96,165,138	3,222,450	13,012,746	54,822,865	(j) 134,505	(c)
2	5,167,210	8,536,983	(D)	(e) 146,267,012	(f)	308,020	(J) 21,629,550	(K) 52,367,997	31,958,684	9,866	2,48
5	3,492,377	7,403,443	13,491,366	175,960,976	1,448,559	0	30,991,002	2,230,131	25,708,358	13,279	(M)
0	43,321,224	34,879,317	21,389,862	49,374,870	0	0	2,999,142	10,924,889	51,277,696	76,064	18,02
9	0	0	7,318,457	82,638,360	0	0	33,491,625	365,144	19,446,783	0	
0	8,607,316	11,711,391	3,212,364	58,592,062	3,147,542	0	855,636	11,185,593	16,883,497	28,729	(N) 8,42
0	(b) 6,225,837	(c)	1,838,339	62,213,681	259,832	5,318,555	11,087,050	3,290,796	12,895,570	(j) 13,725	(c)
4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
0	401,411,000	384,134,000	.....	(O) 1,434,466,000	0	911,601,000	277,801,000	14,559,000	354,328,000	769,980	114,38
0	229,321,950	244,649,625	69,181,670	1,037,393,112	0	137,475,434	93,078,893	22,288,100	309,160,316	430,820	67,63

ailed Data on Generator Rating, Output, Customers
All Systems Having an Output Over 100,000,000 Kw.

7	Generated and Purchased Output, 1927			Distribution of Energy in Kilowatt-Hours, 1927							
ting of erators, Kva.	Total Output, Kw.-Hr.	Generated, Kw.-Hr.	Purchased, Kw.-Hr.	Sold to Residential Customers	Sold to Commercial Lighting Customers (*vv*)	Sold to Municipalities (*ww*)	Sold to Power Customers (*vv*)	Other Sales (Heating, Etc.)	Sold to Electric Railways	Sold to Other Public Utilities	Int
(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	
148,500	1,104,515,429	982,267,178	122,248,764	42,739,877	79,477,428	17,008,496	400,600,923	(R) 57,294,612	44,908,605	297,454,573	
0	748,502,053	718,027,746	30,474,307	98,562,960	163,748,258	21,637,066	243,799,354	0	4,377,910	(m) 74,484,137	
67,500	354,762,797	268,857,180	85,905,617	0	0	21,247,060	112,297,404	0	28,546,440	155,254,914	
30,600	354,047,654	319,334,234	34,713,420	29,422,192	21,199,669	5,551,301	184,301,654	0	19,925,153	(o) 33,145,028	
0	222,132,700	222,129,700	3,000	(b) 78,194,812	(c)	.....	110,474,097	.....	.....	3,944,910	
72,930	220,727,440	217,220,750	3,506,690	13,096,380	11,993,538	6,244,599	101,071,034	6,041,310	(q) 28,372,964	(r)	
2,250	220,324,000	157,383,000	62,941,000	21,528,000	34,334,000	(d) 3,600,000	59,421,000	0	6,486,000	75,123,000	
0	173,617,378	173,617,378	0	(b) 15,050,365	(c)	2,368,442	(e) 122,173,419	(f)	657,797	18,167,291	
1,750	165,318,271	46,847,643	118,470,628	9,921,847	8,815,418	3,058,615	110,350,244	0	0	15,197,827	
26,500	116,194,720	99,713,920	16,480,800	11,934,369	12,624,501	3,858,228	33,793,336	0	14,272,969	15,762,670	
0	115,393,187	115,378,600	14,587	2,386,579	2,757,806	881,299	31,034,418	57,971	5,667,800	65,915,000	
0	112,890,480	101,112,400	11,778,080	15,279,816	17,995,611	1,566,560	53,148,367	.....	.....	136,281	
0	108,254,302	948,000	107,306,302	5,244,758	6,686,316	2,871,107	76,965,354	0	0	5,924,456	
3,050	101,315,500	61,648,500	39,667,000	14,266,185	14,645,759	6,987,437	43,937,454	0	1,917,147	6,138,000	
353,390	4,117,996,424	3,484,486,229	633,510,195	.....	.....	.....	.....	.....	.....	.....	
550,000	4,634,341,084	3,642,781,815	991,559,269	152,154,721	256,409,212	76,204,325	2,955,461,052	14,404,131	187,698,725	608,382,252	
0	2,877,090,621	2,877,038,921	51,700	(i) 1,968,688,525	(c)	104,908,877	(c)	(c)	238,667,027	7,870,100	
0	1,860,613,091	1,859,508,620	1,104,471	152,056,338	226,251,325	55,695,473	685,167,949	0	(k) 392,104,983	151,734,615	
55,655	1,727,565,353	1,709,325,745	18,239,608	81,199,957	82,281,430	22,979,691	1,133,187,114	0	88,101,795	103,450,184	
0	1,701,886,359	1,563,285,739	138,600,620	(b) 413,246,455	(c)	49,981,550	717,427,571	0	232,183,864	8,935,000	
0	1,328,526,578	1,250,958,502	77,568,076	144,616,775	98,893,682	26,148,735	638,632,739	16,912,450	224,879,575	623,648	
195,110	1,249,808,094	631,474,357	618,333,737	76,455,690	69,548,621	43,867,267	534,422,488	3,905,663	(y) 95,078,414	(z) 166,222,520	(A)
0	957,946,741	957,940,641	6,100	202,439,183	169,851,412	33,424,584	344,874,412	0	3,482,200	563,900	(B)
40,450	908,579,200	606,186,500	302,392,700	47,406,463	45,900,944	22,728,956	602,112,930	0	63,207,005	47,309,573	
21,960	782,173,960	551,396,458	230,777,502	27,555,967	34,900,404	(D)	(e) 287,698,820	(f)	35,797,607	(E) 262,398,932	
119,750	634,248,100	634,248,100	0	0	0	0	0	0	0	572,405,600	
48,000	413,209,393	408,502,830	4,706,563	28,242,949	25,061,038	5,386,045	264,437,023	62,888	13,017,418	6,596,435	
105,120	411,462,360	386,421,840	25,040,520	(b) 11,985,075	(c)	1,889,554	213,648,725	1,280,348	12,480	145,919,334	
46,530	352,809,582	292,217,256	60,592,326	38,628,444	(F) 172,416,563	15,425,336	(G)	0	41,585,762	8,623,104	
0	237,512,000	232,078,000	5,434,000	.....	.....	.....	.....	.....	.....	.....	
5,125	226,892,235	224,005,750	2,886,485	17,975,621	10,810,823	2,539,235	116,550,692	17,255	17,866,241	21,987,851	
29,626	212,368,156	126,418,000	85,950,156	9,758,597	13,062,100	8,812,570	58,172,946	0	2,877,490	85,834,469	
0	195,180,800	172,316,900	22,863,900	5,647,106	5,579,922	2,832,004	79,275,880	0	0	79,748,135	
0	157,892,000	127,442,000	30,450,000	.....	.....	.....	.....	.....	.....	.....	
300	135,474,100	0	135,474,100	10,214,617	12,889,984	8,789,854	63,749,310	2,426,000	26,016	1,377,440	
0	109,786,578	98,141,260	11,645,318	8,284,175	8,179,356	1,290,769	49,595,062	0	0	15,748,394	
0	107,715,140	107,628,140	87,000	9,947,845	4,647,952	8,873,806	50,082,657	0	22,716,781	0	
1,339,691	21,223,081,525	18,459,317,374	2,763,764,151	.....	.....	.....	.....	.....	.....	.....	
658,082	1,745,776,428	1,738,266,328	7,510,100	(H)	(H)	(H)	(H) 1,481,116,722	(H)	(H)	(H)	
33,066	1,095,378,000	1,058,809,000	36,569,000	.....	.....	.....	.....	.....	.....	.....	
600	786,877,691	407,921,190	378,956,501	79,934,496	85,671,107	15,661,616	393,633,819	0	128,478,332	0	
36,300	426,426,000	295,239,000	131,187,000	18,797,604	17,710,318	22,432,960	271,586,536	0	0	15,096,459	
29,010	409,680,096	403,785,396	5,894,700	27,219,736	33,632,436	9,414,754	223,946,461	6,269,415	1,990,260	12,283,450	
0	383,128,587	383,127,090	1,497	(b) 137,705,126	(c)	9,634,694	(e) 68,565,568	(f)	96,165,138	3,222,450	
26,569	266,235,456	234,320,644	32,014,812	5,167,210	8,536,983	(D)	(e) 146,267,012	(f)	308,020	(J) 21,629,550	(K)
63,150	260,726,212	258,596,137	2,130,075	3,492,377	7,403,443	13,491,366	175,960,976	1,448,559	0	30,991,002	
0	214,167,000	213,290,000	877,000	43,321,224	34,879,317	21,389,862	49,374,870	0	0	2,999,142	
18,000	143,260,369	47,216,400	96,043,969	0	0	7,318,457	82,638,360	0	0	33,491,625	
600	114,195,401	113,157,131	1,038,270	8,607,316	11,711,391	3,212,364	58,592,062	3,147,542	0	855,636	
25,775	102,229,660	70,183,660	32,046,000	(b) 6,225,837	(c)	1,838,339	62,213,681	259,832	5,318,555	11,087,050	
919,826	5,948,080,900	5,223,811,976	724,268,924	.....	.....	.....	.....	.....	.....	.....	
0	3,778,380,000	3,575,456,000	202,924,000	401,411,000	384,134,000	.....	(O) 1,434,466,000	0	911,601,000	277,801,000	
9,160	2,142,549,100	2,141,046,200	1,502,900	229,321,950	244,649,625	69,181,670	1,037,393,112	0	137,475,434	93,078,893	

| | | |

	South Atlantic States											
37	Duke Power Company		7		244,313	38		658,082	1,745,776,428	1,738,266,328	7,510,100	
38	Appalachian Electric Power Company		9	(a)	297,400	4	(a)	33,066	1,095,378,000	1,058,809,000	36,569,000	
39	Consolidated Gas Elec. Lt. & Pwr. Co. of Baltimore		3	(a)	221,000	1	(a)	600	786,877,691	407,921,190	378,956,501	
40	Carolina Power & Light Company		5	(a)	84,710	12	(a)	36,300	426,426,000	295,239,000	131,187,000	
41	Virginia Electric & Power Company		8	(a)	133,220	9	(a)	29,010	409,680,096	403,785,396	5,894,700	
42	Potomac Electric Power Company		1		150,222	0		0	383,128,587	383,127,090	1,497	(b)
43	South Carolina System (I)		2		60,000	3		26,569	266,235,456	234,320,644	32,014,812	
44	Columbus Electric & Power Company and Subsidiary	(L)	17	(a)	13,373	10	(a)	63,150	260,726,212	258,596,137	2,130,075	
45	Florida Power & Light Company		31	(a)	138,031	0		0	214,167,000	213,290,000	877,000	
46	Central Georgia Power Company		0		0	1		18,000	143,260,369	47,216,400	96,043,969	
47	Tampa Electric Company and Subsidiaries		5	(a)	37,075	1	(a)	600	114,195,401	113,157,131	1,038,270	
48	Augusta-Aiken Railway & Electric Corporation		1		1,100	2		25,775	102,229,660	70,183,660	32,046,000	(b)
	Totals for section		89		1,543,635	81		919,826	5,948,080,900	5,223,811,976	724,268,924	
	East North Central States											
49	Commonwealth Edison Company		6	(a)	1,004,500	0		0	3,778,380,000	3,575,456,000	202,924,000	
50	The Detroit Edison Company		4	(a)	633,000	9	(a)	9,160	2,142,549,100	2,141,046,200	1,502,900	
51	The Cleveland Electric Illuminating Company		4	(a)	371,350	0		0	1,138,838,831	1,138,543,141	295,690	
52	The Ohio Power Company		14	(a)	228,020	4	(a)	2,850	1,131,133,000	970,020,000	161,113,000	
53	North American Company (Wisconsin-Michigan System)		12	(a,P)	295,580	10	(a,P)	15,943	1,026,886,645	911,951,416	114,935,229	(b)
54	Columbia Gas & Electric Corporation System		13	(a)	317,893	0		0	936,704,222	934,771,719	1,932,503	
55	Consumers Power Company		10	(a)	149,200	34	(a)	108,505	930,285,847	806,130,483	124,155,364	
56	Public Service Company of Northern Illinois		15	(a)	246,275	3	(a)	4,100	884,762,116	745,137,852	139,624,264	
57	Pennsylvania-Ohio Power & Light Company		3		213,125	0		0	574,290,447	570,072,450	4,217,997	
58	Ohio Public Service Company		7		155,374	1		900	495,592,161	322,022,364	173,570,797	
59	Indiana & Michigan Electric Company		2	(a)	94,000	4	(a)	22,879	390,808,000	388,637,000	2,171,000	
60	Toledo Edison Company		4	(a)	125,180	2	(a)	6,950	382,228,176	305,977,188	76,250,988	
61	Northern Ohio Power & Light Company		1	(a)	67,000	1	(a)	2,000	379,630,884	196,056,900	183,573,984	
62	Indianapolis Power & Light Company		5		131,000	0		0	328,712,384	292,495,723	36,216,661	
63	Central Indiana Power Company Subsidiaries		12		106,275	1		480	305,326,889	253,225,580	52,101,309	
64	Central Illinois Public Service Company		14		90,625	0		0	301,548,168	201,866,710	99,681,458	
65	Wisconsin Power & Light Company		10		30,000	34		46,900	275,376,599	248,549,077	26,827,522	
66	Michigan Northern Power Company		0		0	1		45,600	271,701,688	271,701,688	0	
67	Northern Indiana Public Service Company		5	(a)	43,275	4	(a)	490	271,440,543	73,479,811	197,960,732	
68	Columbus Railway, Power & Light Company		3		180,000	0		0	254,843,000	254,843,000	0	
69	Interstate Public Service Company		2		47,840	5		6,810	237,227,562	142,108,976	95,118,586	
70	Illinois Electric Power Company		1	(a)	50,000	0		0	213,752,872	213,696,972	55,900	
71	City of Cleveland, Division of Light & Power		1		60,400	0		0	174,146,677	174,146,677	0	
72	Wisconsin Public Service Corporation		3	(a)	39,750	9	(a)	29,618	153,364,676	148,864,596	4,500,080	
73	Central Illinois Light Company		2	(a)	33,500	0		0	135,692,265	1,323,043	134,369,222	
74	Indiana Service Corporation		1		37,850	0		0	131,861,909	107,558,797	24,303,112	
75	Moline-Rock Island Manufacturing Company		2		71,500	2		5,100	131,017,494	96,797,000	34,220,494	
76	Indiana General Service Company		3	(a)	39,200	0		0	105,634,000	104,530,000	1,104,000	
	Totals for section		159		5,513,989	124		344,290	17,483,737,155	15,591,010,363	1,892,726,792	
	West North Central States											
77	North American Company (Mo., Ill. and Iowa System)		7	(a)	368,020	1	(a)	135,000	1,449,881,883	1,449,850,747	31,136	
78	Northern States Power Company (Del.) and Subsidiaries		23	(a)	220,460	26	(a)	109,495	839,375,628	761,475,716	77,899,912	
79	Kansas City Power & Light Company		5		232,308	0		0	488,156,281	487,890,659	265,622	
80	Minnesota Power & Light Company		5	(a)	12,350	11	(a)	94,865	401,856,000	400,198,000	1,658,000	
81	Empire District Electric Company		2	(a)	67,710	3	(a)	15,050	262,409,515	262,339,375	70,140	
82	Kansas Gas & Electric Company		8	(a)	75,190	1	(a)	550	221,118,000	221,039,000	79,000	
83	Nebraska Power Company		3	(a)	73,565	1	(a)	126	201,094,000	201,094,000	0	
84	Des Moines Electric Light Company		3		75,060	1		300	134,416,934	133,691,874	725,060	
	Totals for section		56		1,269,368	44		418,300	3,998,308,241	3,917,579,371	80,728,870	
	East South Central States											
85	Southeastern Power & Light Company System		61	(T)	199,603	25	(T)	487,660	2,215,947,000	1,611,536,000	604,411,000	
86	The Tennessee Electric Power Company		4	(a)	103,750	7	(a)	108,052	651,397,468	644,846,518	6,550,950	
87	War Department, U. S. A. (Muscle Shoals)		0		0	1		230,937	565,609,500	(U) 565,609,500	0	
88	New Orleans Public Service, Inc.		4	(a)	114,200	0		0	319,842,000	319,842,000	0	
89	Birmingham Electric Company		1	(a)	11,700	0		0	289,073,000	0	289,073,000	
90	Louisville Gas & Electric Company (Del.) and Subsidiaries		2	(a)	93,520	0		0	234,238,160	195,553,200	38,684,960	
91	Kentucky Utilities Company		26	(a)	58,392	0		0	185,904,592	122,364,800	63,539,792	
92	Kentucky & West Virginia Power Company		1	(a)	19,500	0		0	168,960,000	41,068,000	127,892,000	
93	Memphis Power & Light Company		1	(a)	54,000	0		0	166,244,000	166,169,000	75,000	
	Totals for section		100		734,603	33		845,697	4,797,215,720	3,666,989,018	1,130,226,702	
	West South Central States											
94	Oklahoma Gas & Electric Company		25	(a)	100,091	0		0	399,543,412	367,513,842	32,029,570	
95	Houston Lighting & Power Company		8	(a)	99,731	0		0	362,094,000	361,566,000	528,000	
96	Texas Power & Light Company		31	(a)	68,953	3	(a)	340	355,707,000	252,269,000	103,438,000	
97	Louisiana Power & Light Company		15	(a)	31,157	0		0	250,542,000	195,222,000	55,320,000	
98	Texas Electric Service Company		18	(a)	37,220	0		0	241,723,000	222,578,000	19,145,000	
99	Arkansas Power & Light Company		19	(a)	41,726	2	(a)	9,825	183,843,000	107,409,000	76,434,000	
100	Dallas Power & Light Company		1	(a)	57,500	0		0	171,925,970	170,213,490	1,712,480	
101	Gulf States Utilities Company		10	(a)	46,203	0		0	155,783,691	155,734,941	48,750	
102	Fort Worth Power & Light Company		1	(a)	44,000	0		0	140,230,159	140,023,200	206,959	
103	Public Service Company of Oklahoma		17		73,431	0		0	135,199,859	90,605,352	44,594,507	(b)
104	Central Power & Light Company		52		49,555	4		2,972	120,521,353	104,154,723	16,366,630	
	Totals for section		197		742,486	9		14,932	2,517,113,444	2,167,289,548	349,823,896	
	Mountain States											
105	The Montana Power Company		0		0	9		245,000	1,366,997,834	1,366,997,834	0	
106	Utah Power & Light Company		4	(a)	37,040	36	(a)	188,847	784,402,000	615,158,000	169,244,000	
107	Idaho Power Company		0		0	8	(a)	71,500	352,253,000	330,817,000	21,436,000	
108	Public Service Company of Colorado		10		97,137	6		32,687	285,892,553	280,448,746	5,443,807	
109	Salt River Valley Water Users' Association		0		0	(Y) 7		64,400	206,356,017	206,218,975	137,042	
	Totals for section		14		140,737	66		702,087	2,995,901,404	2,799,640,555	196,260,849	
	Pacific States											
110	Southern California Edison Company		3		269,955	20		348,350	2,421,357,098	2,409,869,298	11,487,800	
111	Pacific Gas & Electric Company (Z)		9	(a)	153,875	32	(a)	463,425	2,322,015,035	1,566,646,081	755,368,954	(b)
112	Western Power Corporation Subsidiaries	(bb)	7	(a)	82,000	(bb) 14	(a)	244,574	1,351,590,977	1,180,851,704	170,739,273	

(H)	(H)	(H)	(H) 1,481,116,722	(H)	(H)	(H)		264,659,706			
									70,411	12,699	
79,934,496	85,671,107	15,661,616	393,633,819	0	128,478,332	0	6,534,011	76,964,310	164,397	24,221	
18,797,604	17,710,318	22,432,960	271,586,536	0	0	15,096,459		80,802,123	45,567	14,549	
27,219,736	33,632,436	9,414,754	223,946,461	6,269,415	1,990,260	12,283,450	41,895,698	53,027,886	79,431	13,649	
(b) 137,705,126	(c)	9,634,694	(e) 68,565,568	(f)	96,165,138	3,222,450	13,012,746	54,822,865	(j) 134,505	(c)	
5,167,210	8,536,983	(D)	(e) 146,267,012	(f)	308,020	(J) 21,629,550	(K) 52,367,997	31,958,684	9,866	2,480	
3,492,377	7,403,443	13,491,366	175,960,976	1,448,559	0	30,991,002	2,230,131	25,708,358	13,279	(M)	
43,321,224	34,879,317	21,389,862	49,374,870	0	0	2,999,142	10,924,889	51,277,696	76,064	18,024	
0	0	7,318,457	82,638,360	0	0	33,491,625	365,144	19,446,783	0	0	
8,607,316	11,711,391	3,212,364	58,592,062	3,147,542	0	855,636	11,185,593	16,883,497	28,729	(N) 8,427	
(b) 6,225,837	(c)	1,838,339	62,213,681	259,832	5,318,555	11,087,050	3,290,796	12,895,570	(j) 13,725	(c)	
401,411,000	384,134,000		(O) 1,434,466,000	0	911,601,000	277,801,000	14,559,000	354,328,000	769,980	114,380	
229,321,950	244,649,625	69,181,670	1,037,393,112	0	137,475,434	93,078,893	22,288,100	309,160,316	430,820	67,631	
133,259,334	76,076,427	17,518,321	550,786,660	0	129,359,394	102,609,381	4,050,552	125,178,762	246,258	33,337	
									140,588	22,721	
(b) 210,276,123	(c)	9,555,560	486,667,349	0	3,499,072	54,435,744	129,518,162	132,934,635	(j) 260,253	(c)	
94,705,229	85,100,738	29,473,211	461,928,390	0	89,417,107	24,017,683	11,962,550	140,099,314	240,862	34,159	
89,003,710	83,418,773	14,970,754	483,311,655	0	65,779,232	3,783,265	6,740,141	183,278,317	220,817	33,613	
84,226,246	42,271,149	41,644,077	285,216,059	5,225,745	92,972,747	188,162,855	9,154,952	135,888,286	208,482	26,299	
36,950,438 (Q)	39,479,346	2,392,870	273,853,971	0	32,614,573	87,520,075	32,898,540	68,580,634	74,227	(Q) 10,703	
28,740,072	26,468,505	5,925,509	305,806,854	0	0	70,855,409	5,506,277	52,290,535	62,710	9,961	
									39,967	4,149	
32,739,235	40,053,383	6,925,242	175,246,409	0	0	61,551,709	3,549,337	62,162,861	79,144	9,723	
33,104,593	24,189,676	22,652,625	200,970,067	0	(R) 41,781,483	5,700,026	1,413,990	49,818,424	55,715	7,223	
33,665,323	72,201,099	17,716,408	124,201,198	716,242	0	8,965,390	12,584,670	58,662,054	94,784	8,462	
12,272,918	11,243,772	5,499,712	77,671,353	1,652,270	86,702,790	47,324,241	17,022,809	45,937,024	43,966	8,442	
25,437,091	21,047,841	12,260,938	118,474,630	8,341,165	2,043,814	28,098,988	34,656,244	51,187,457	(l) 105,288	(l) 20,936	
16,899,789	18,266,625	16,589,391	42,124,562	2,445,261	1,282,400	121,009,828	17,069,420	39,689,323	54,581	9,269	
0	0	0	268,801,782	0	623,900	1,934,563	341,443		0	0	
18,028,867	17,893,692	11,416,791	146,254,473	1,775,797	31,478,222	1,156,468	1,464,509	41,971,724	52,890	8,693	
31,778,365	38,989,697	2,027,082	95,906,187	224,961	32,485,563	13,841,560		39,589,585	70,912	9,144	
18,448,799	16,775,714	8,471,536	96,647,865	2,965,200	0	23,352,974	27,591,288	42,974,186	67,915	12,106	
0	0	0	0	0	0	209,412,453	0	4,340,419	0	0	
19,598,590	15,758,951	7,766,855	77,838,292	18,429,631	0	0		34,754,358	(j) 42,773	(c)	
8,742,656	9,802,587	4,148,744	87,152,054	0	1,788,250	6,148,454	6,558,496	29,023,435	28,921	5,982	
11,693,975	10,710,248	4,002,833	81,800,114	756,525	0	13,301,799	138,822	13,287,949	31,261	5,593	
6,490,284	10,647,540	5,606,896	57,920,211	0	4,391,988	8,328,343	30,205,884	8,270,763	16,486	2,934	
0	0	0	0	0	20,492,310	101,811,145	5,259,039	3,455,000	0	0	
									29,390	2,070	
116,215,556	137,403,422	27,581,716	621,052,661	0	158,794,948	164,282,155	29,917,480	194,633,945	254,876	(S) 42,936	
101,727,071	113,815,495	67,621,817	325,105,870	0	2,791,593	39,239,650	12,447,566	176,626,566	265,067	45,966	
50,744,171	52,443,812	14,702,360	212,428,294	116,132	82,297,000	20,411,040	2,045,297	52,968,175	101,332	19,282	
15,298,435	14,958,391	26,658,693	218,136,421	935,017	15,058,976	40,382,380		70,427,687	37,474	7,282	
5,718,735	7,687,444	494,623	173,598,251	0	0	28,122,307	863,319	45,924,836	20,098	1,683	
19,159,123	20,208,018	7,480,460	117,031,578	4,552,200	0	16,849,770		35,836,851	45,206	8,162	
23,386,763	31,693,691	6,150,026	91,262,982	134,280	0	28,000,137		19,466,121	51,476	8,149	
16,118,109	9,469,178	1,919,691	62,315,074	380,639	0	18,715,038	5,075,374	20,423,831	41,949	4,656	
72,743,000	80,866,000	15,678,000	1,204,080,000	18,974,000	0	289,120,000	111,937,000	423,089,000	176,816	41,876	
29,180,518	24,943,552	3,015,030	326,363,627	0	5,308,380	120,172,039	51,985,917	90,428,405	72,285	15,314	
0	0	0	0	0	0	557,025,000	(V) 8,584,500	0	0	0	
26,887,637	24,971,108	11,683,485	107,488,765	0	48,621,418	0	56,976,311	44,213,276	67,472	12,823	
16,275,270	24,104,568	5,136,818	156,950,194	0	0	0	50,516,817	36,089,333	46,987	8,606	
25,681,219	37,815,877	8,625,914	93,639,571	0	0	39,595,452	3,374,407	25,505,720	70,891	11,157	
9,165,512	9,909,003	5,173,873	96,335,329	0	0	28,123,316	13,092,751	24,104,808	36,769	13,609	
									11,714	2,565	
14,038,153	38,721,226	5,621,240	36,208,118	0	0	51,056,434		20,092,751	35,291	8,14	
24,801,103	32,420,137	12,549,343	219,600,835	0	2,049,481	23,550,663	6,436,992	78,134,858	73,733	17,503	
21,738,990	16,780,834	18,305,187	198,904,663	0	55,201,122	12,276,415		38,886,789	57,624	9,987	
24,588,491	17,061,465	18,964,896	176,030,230	0	21,508,378	30,518,869		67,034,671	69,340	18,754	
3,825,601	1,903,356	2,179,257	118,767,813	157,575	0	96,475,430		27,232,968	11,070	3,446	
9,705,254	10,679,009	5,600,523	67,150,801	0	1,462,400	103,450,553		43,674,460	24,385	7,27	
10,757,377	18,278,125	7,614,763	73,725,528	0	667,260	20,659,132		52,140,815	38,039	11,50	
20,336,844	24,484,079	10,919,230	61,387,141	0	41,653,154	673,848		12,471,674	51,128	6,73	
7,156,947	8,508,064	3,709,138	83,835,585	0	4,239,730	23,403,052	5,063,125	19,868,050	(i) 28,444	(c)	
9,195,701	10,674,631	8,508,148	85,001,260	0	0	11,084,500		15,765,919	29,445	4,149	
(b) 23,274,247	(c)	5,575,359	62,674,942	543,961	(D)	(W) 14,348,907	10,185,305	18,597,138	(b) 44,585	(c)	
6,536,392	10,782,414	4,311,639	33,006,514	(X) 6,553,447	0	2,519,076	32,989,177	23,822,694	28,087	13,40	
18,073,861	17,254,521	11,761,972	(k) 1,099,825,826	3,974,939	9,433,441	10,837,767	(g)	(h) 195,835,507	36,633	8,81	
36,340,105	34,779,646	12,046,596	523,054,193	0	53,487,476	1,052,623		123,641,361	83,167	11,61	
38,002,012	12,214,087	7,947,957	67,636,093	0	3,561,725	174,262,378		48,628,748	33,022	5,32	
31,078,971	45,649,151	8,682,334	121,144,772	0	421,380	15,636,967	9,027,982	54,250,996	95,163	15,35	
1,139,780	0	6,700,834	129,845,500	0	0	18,300,013	27,692,680	22,677,210	775		
99,056,462	73,312,043	479,181,909	850,469,798	39,113,530	310,368,646	23,185,162	24,542,386	522,127,162	(l) 302,328	(l) 36,95	
(b) 278,377,270	(c)	(Q) 45,975,340	952,961,934	44,592,037	279,922,657	56,135,805	75,079,781	588,970,211	(b, aa) 451,932	(c)	
									(i) 153,312		

658,082	1,745,776,428	1,738,266,328	7,510,100	(H)	(H)	(H)	(H)	1,481,116,722	(H)	(H)	(H)	
33,066	1,095,378,000	1,058,809,000	36,569,000									0
600	786,877,691	407,921,190	378,956,501		79,934,496	85,671,107	15,661,616	393,633,819	0	128,478,332		
36,300	426,426,000	295,239,000	131,187,000		18,797,604	17,710,318	22,432,960	271,586,536	0	0		15,096,459
29,010	409,680,096	403,785,396	5,894,700		27,219,736	33,632,436	9,414,754	223,946,461	6,269,415	1,990,260		12,283,450
0	383,128,587	383,127,090	1,497	(b)	137,705,126	(c)	9,634,694	(e) 68,565,568	(f)	96,165,138		3,222,450
26,569	266,235,456	234,320,644	32,014,812		5,167,210	8,536,983	(D)	(e) 146,267,012	(f)	308,020	(J)	21,629,550
63,150	260,726,212	258,596,137	2,130,075		3,492,377	7,403,443	13,491,366	175,960,976	1,448,559	0		30,991,002
0	214,167,000	213,290,000	877,000		43,321,224	34,879,317	21,389,862	49,374,870	0	0		2,999,142
18,000	143,260,369	47,216,400	96,043,969		0	0	7,318,457	82,638,360	0	0		33,491,625
600	114,195,401	113,157,131	1,038,270		8,607,316	11,711,391	3,212,364	58,592,062	3,147,542	0		855,636
25,775	102,229,660	70,183,660	32,046,000	(b)	6,225,837	(c)	1,838,339	62,213,681	259,832	5,318,555		11,087,050
919,826	5,948,080,900	5,223,811,976	724,268,924									
0	3,778,380,000	3,575,456,000	202,924,000		401,411,000	384,134,000		(O) 1,434,466,000	0	911,601,000		277,801,000
9,160	2,142,549,100	2,141,046,200	1,502,900		229,321,950	244,649,625	69,181,670	1,037,393,112	0	137,475,434		93,078,893
0	1,138,838,831	1,138,543,141	295,690		133,259,334	76,076,427	17,518,321	550,786,660	0	129,359,394		102,609,381
2,850	1,131,133,000	970,020,000	161,113,000									
(P) 15,943	1,026,886,645	911,951,416	114,935,229	(b)	210,276,123	(c)	9,555,560	486,667,349	0	3,499,072		54,435,744
0	936,704,222	934,771,719	1,932,503		94,705,229	85,100,738	29,473,211	461,928,390	0	89,417,107		24,017,683
108,505	930,285,847	806,130,483	124,155,364		89,003,710	83,418,773	14,970,754	483,311,655	0	65,779,232		3,783,265
4,100	884,762,116	745,137,852	139,624,264		84,226,246	42,271,149	41,644,077	285,216,059	5,225,745	92,972,747		188,162,855
0	574,290,447	570,072,450	4,217,997		36,950,438	(Q) 39,479,346	2,392,870	273,853,971	0	32,614,573		87,520,075
900	495,592,161	322,022,364	173,570,797		28,740,072	26,468,505	5,925,509	305,806,854	0	0		70,855,409
22,879	390,808,000	388,637,000	2,171,000									
6,950	382,228,176	305,977,188	76,250,988		32,739,235	40,053,383	6,925,242	175,246,409	0	0		61,551,709
2,000	379,630,884	196,056,900	183,573,984		33,104,593	24,189,676	22,652,625	200,970,067	0	(R) 41,781,483		5,700,026
0	328,712,384	292,495,723	36,216,661		33,665,323	72,201,099	17,716,408	124,201,198	716,242	0		8,965,390
480	305,326,889	253,225,580	52,101,309		12,272,918	11,243,772	5,499,712	77,671,353	1,652,270	86,702,790		47,324,241
0	301,548,168	201,866,710	99,681,458		25,437,091	21,047,841	12,260,938	118,474,630	8,341,165	2,043,814		28,098,988
46,900	275,376,599	248,549,077	26,827,522		16,899,789	18,266,625	16,589,391	42,124,562	2,445,261	1,282,400		121,009,828
45,600	271,701,688	271,701,688	0		0	0	0	268,801,782	0	623,900		1,934,563
490	271,440,543	73,479,811	197,960,732		18,028,867	17,893,692	11,416,791	146,254,473	1,775,797	31,478,222		1,156,468
0	254,843,000	254,843,000	0		31,778,365	38,989,697	2,027,082	95,906,187	224,961	32,485,563		13,841,560
6,810	237,227,562	142,108,976	95,118,586		18,448,799	16,775,714	8,471,536	96,647,865	2,965,200	0		23,352,974
0	213,752,872	213,696,972	55,900		0	0	0	0	0	0		209,412,453
0	174,146,677	174,146,677	0		19,598,590	15,758,951	7,766,855	77,838,292	18,429,631	0		0
29,618	153,364,676	148,864,596	4,500,080		8,742,656	9,802,587	4,148,744	87,152,054	0	1,788,250		6,148,454
0	135,692,265	1,323,043	134,369,222		11,693,975	10,710,248	4,002,833	81,800,114	756,525	0		13,301,799
0	131,861,909	107,558,797	24,303,112		6,490,284	10,647,540	5,606,896	57,920,211	0	4,391,988		8,328,343
5,100	131,017,494	96,797,000	34,220,494		0	0	0	0	0	20,492,310		101,811,145
0	105,634,000	104,530,000	1,104,000									
344,290	17,483,737,155	15,591,010,363	1,892,726,792									
135,000	1,449,881,883	1,449,850,747	31,136		116,215,556	137,403,422	27,581,716	621,052,661	0	158,794,948		164,282,155
109,495	839,375,628	761,475,716	77,899,912		101,727,071	113,815,495	67,621,817	325,105,870	0	2,791,593		39,239,650
0	488,156,281	487,890,659	265,622		50,744,171	52,443,812	14,702,360	212,428,294	116,132	82,297,000		20,411,040
94,865	401,856,000	400,198,000	1,658,000		15,298,435	14,958,391	26,658,693	218,136,421	935,017	15,058,976		40,382,380
15,050	262,409,515	262,339,375	70,140		5,718,735	7,687,444	494,623	172,598,251	0	0		28,122,307
550	221,118,000	221,039,000	79,000		19,159,123	20,208,018	7,480,460	117,031,578	4,552,200	0		16,849,770
126	201,094,000	201,094,000	0		23,386,763	31,693,691	6,150,026	92,262,982	134,280	0		28,000,137
300	134,416,934	133,691,874	725,060		16,118,109	9,469,178	1,919,691	62,315,074	380,639	0		18,715,038
418,300	3,998,308,241	3,917,579,371	80,728,870									
487,660	2,215,947,000	1,611,536,000	604,411,000		72,743,000	80,866,000	15,678,000	1,204,080,000	18,974,000	0		289,120,000
108,052	651,397,468	644,846,518	6,550,950		29,180,518	24,943,552	3,015,030	326,363,627	0	5,308,380		120,172,039
230,937	565,609,500	(U) 565,609,500	0		0	0	0	0	0	0		557,025,000
0	319,842,000	319,842,000	0		26,887,637	24,971,108	11,683,485	107,488,765	0	48,621,418		0
0	289,073,000	0	289,073,000		16,275,270	24,104,568	5,136,818	156,950,194	0	0		0
0	234,238,160	195,553,200	38,684,960		25,681,219	37,815,877	8,625,914	93,639,571	0	0		39,595,452
0	185,904,592	122,364,800	63,539,792		9,165,512	9,909,003	5,173,873	96,335,329	0	0		28,123,316
0	168,960,000	41,068,000	127,892,000									
0	166,244,000	166,169,000	75,000		14,038,153	38,721,226	5,621,240	36,208,118	0	0		51,056,434
845,697	4,797,215,720	3,666,989,018	1,130,226,702									
0	399,543,412	367,513,842	32,029,570		24,801,103	32,420,137	12,549,343	219,600,835	0	2,049,481		23,550,663
0	362,094,000	361,566,000	528,000		21,738,990	16,780,834	18,305,187	198,904,663	0	55,201,122		12,276,415
340	355,707,000	252,269,000	103,438,000		24,588,491	17,061,465	18,964,896	171,030,230	0	21,508,378		30,518,869
0	250,542,000	195,222,000	55,320,000		3,825,601	1,903,356	2,179,257	118,767,813	157,575	0		96,475,430
0	241,723,000	222,578,000	19,145,000		9,705,254	10,679,009	5,600,523	67,150,801	0	1,462,400		103,450,553
9,825	183,843,000	107,409,000	76,434,000		10,757,377	18,278,125	7,614,763	72,725,528	0	667,260		20,659,132
0	171,925,970	170,213,490	1,712,480		20,336,844	24,484,079	10,919,230	61,387,141	0	41,653,154		673,848
0	155,783,691	155,734,941	48,750		7,156,947	8,508,064	3,709,138	93,835,585	0	4,239,730		23,403,052
0	140,230,159	140,023,200	206,959		9,195,701	10,674,631	8,508,148	85,001,260	0	0		11,084,500
0	135,199,859	90,605,352	44,594,507	(b)	23,274,247	(c)	5,575,359	62,674,942	543,961	(D)	(W)	14,348,907
2,972	120,521,353	104,154,723	16,366,630		6,536,392	10,782,414	4,311,639	33,006,514	(X) 6,553,447	0		2,519,076
14,932	2,517,113,444	2,167,289,548	349,823,896									
245,000	1,366,997,834	1,366,997,834	0		18,073,861	17,254,521	11,761,972	(k) 1,099,825,826	3,974,939	9,433,441		10,837,767
188,847	784,402,000	615,158,000	169,244,000		36,340,105	34,779,646	12,046,596	523,054,193	0	53,487,476		1,052,623
71,500	352,253,000	330,817,000	21,436,000		38,002,012	12,214,087	7,947,957	67,636,093	0	3,561,725		174,262,378
32,687	285,892,553	280,448,746	5,443,807		31,078,971	45,649,151	8,682,334	121,144,772	0	421,380		15,636,967
64,400	206,356,017	206,218,975	137,042		1,139,780	0	6,700,834	129,845,500	0	0		18,300,013
702,087	2,995,901,404	2,799,640,555	196,260,849									
348,350	2,421,357,098	2,409,869,298	11,487,800		99,056,462	73,312,043	479,181,909	850,469,798	39,113,530	310,368,646		23,185,162
463,425	2,322,015,035	1,566,646,081	755,368,954	(b)	278,377,270	(c)	(Q) 45,975,340	952,961,934	44,592,037	279,922,657		56,135,805
244,574	1,351,590,977	1,180,851,704	170,739,273									
					76,551,670	69,847,871	12,704,701	350,343,527	0	85,665,458		14,886,450

88	New Orleans Public Service, Inc.	4	(a)	114,200	0	0	319,842,000	319,842,000	0		
89	Birmingham Electric Company	1	(a)	11,700	0	0	289,073,000	0	289,073,000		

		264,659,706										37
			70,411	12,699		3,266	232	10	21			38
0	6,534,011	76,964,310	164,397	24,221	15	254	0	1	0			39
459		80,802,123	45,567	14,549	320	2,655	0	0	11			40
450	41,895,698	53,027,886	79,431	13,649	455	3,343	89	3	11			41
450	13,012,746	54,822,865 (j)	134,505	(c)	(c)	(c)	(c)	(c)	(c)			42
550 (K)	52,367,997	31,958,684	9,866	2,480	(D) (e)	440	(f)	1	3			43
002	2,230,131	25,708,358	13,279	(M)	8	(M)	22	0	5			44
142	10,924,889	51,277,696	76,064	18,024	475	5,206	0	0	7			45
625	365,144	19,446,783	0	0	7	51	0	0	7			46
636	11,185,593	16,883,497	28,729 (N)	8,427	(G)	(G)		0	4			47
050	3,290,796	12,895,570 (j)	13,725	(c)	(c)	(c)	(c)	(c)	(c)			48
000	14,559,000	354,328,000	769,980	114,380		(O) 21,721	0	4	3			49
893	22,288,100	309,160,316	430,820	67,631	160	11,397	0	2	4			50
381	4,050,552	125,178,762	246,258	33,337	66	2,232	0	1	4			51
			140,588	22,721		5,689	889	3	35			52
744	129,518,162	132,934,635 (j)	260,253	(c)	(c)	(c)	0	(c)	(c)			53
683	11,962,550	140,099,314	240,862	34,159	398	9,629	0	17	14			54
265	6,740,141	183,278,317	220,817	33,613		8,667	0					55
855	9,154,952	135,888,286	208,482	26,299	1,392	11,120	3,111	9	9			56
075	32,898,540	68,580,634	74,227 (Q)	10,703	6	1,747	0	Affil'd	3			57
409	5,506,277	52,290,535	62,710	9,961		1,881	0	0	16			58
			39,967	4,149		1,302	129	18	12			59
709	3,549,337	62,162,861	79,144	9,723		2,087	0	0	20			60
026	1,413,990	49,818,424	55,715	7,223		1,597	0					61
390	12,584,670	58,662,054	94,784	8,462	7	226	418	0	2			62
241	17,022,809	45,937,024	43,966	8,442	136	2,004	996	2	22			63
988	34,656,244	51,187,457 (l)	105,288 (l)	20,936 (l)	1,309 (l)	6,209 (l)	6,749 (l)	3 (l)	28			64
828	17,069,420	39,689,323	54,581	9,269	28	2,834	1,909	1	25			65
563	341,443		0	0	0	1	0	1	1			66
468	1,464,509	41,971,724	52,890	8,693	322	1,921	1,206	10	6			67
560		39,589,585	70,912	9,144	1	1,081	851	1	3			68
974	27,591,288	42,974,186	67,915	12,106		2,899	2,088	0				69
453	0	4,340,419	0	0	0	0	0	0	4			70
0		34,754,358 (j)	42,773	(c)	(c)	(c)	(c)	0	0			71
454	6,558,496	29,023,435	28,921	5,982	42	1,612	0	1	9			72
799	138,822	13,287,949	31,261	5,593	1,420			0				73
343	30,205,884	8,270,763	16,486	2,934	18	1,713	0	3	4			74
145	5,259,039	3,455,000	0	0	0	0	0	3	3			75
			29,390	2,070		1,026	32	2	4			76
155	29,917,480	194,633,945	254,876 (S)	42,936	33	(G)	0	4	20			77
650	12,447,566	176,626,566	265,067	45,966	577	16,239	0	5	92			78
040	2,045,297	52,968,175	101,332	19,287	342	4,516	17	1	6			79
380		70,427,687	37,474	7,287	711	1,720		1	5			80
307	863,319	45,924,836	20,098	1,683		1,100	0	0	9			81
770		35,836,851	45,206	8,162	73	1,863		0	8			82
137		19,466,121	51,476	8,149	27	1,788		0	4			83
038	5,075,374	20,423,831	41,949	4,656	7	2,820	62	0	12			84
000	111,937,000	423,089,000	176,816	41,876	77	13,694	2,045	0	66			85
039	51,985,917	90,428,405	72,285	15,314		3,660	0					86
000 (V)	8,584,500	0	0	0	0	0	0	0	1			87
0	56,976,311	44,213,276	67,472	12,823	60	2,405	0	2	0			88
0	50,516,817	36,089,333	46,987	8,606	188	3,074	0	0	0			89
452	3,374,407	25,505,720	70,891	11,157	247	3,475	0	0	3			90
316	13,092,751	24,104,808	36,769	13,609		2,086	0	0				91
			11,714	2,565		556	30		1			92
434		20,092,751	35,291	8,141	45	1,841	0	0	4			93
663	6,436,992	78,134,858	73,733	17,503	410	5,490	0	3	29			94
415		38,886,789	57,624	9,987	22	5,502	0	2	4			95
869		67,034,671	69,340	18,756	484	4,248	0	3	18			96
430		27,232,968	11,070	3,440	96	558	2	0	2			97
553		43,674,460	24,385	7,275	152	1,841	0	1	7			98
132		52,140,815	38,039	11,501	167	2,605	0	1	11			99
848		12,471,674	51,128	6,737	233	2,071	0	1	1			100
052	5,063,125	19,868,050 (f)	28,444	(c)	(c)	(c)	0	(c)	(c)			101
500		15,765,919	29,445	4,149	5	725	0	0	2			102
907	10,185,305	18,597,138 (b)	44,585	(c)		3,028						103
076	32,989,177	23,822,694	28,087	13,406	101	2,882	(X) 984	0	4			104
767	(g)	(h) 195,835,507	36,633	8,817	435	(k) 2,414	1,529	2	14			105
623		123,641,361	83,167	11,612	232	3,723	0	6	6			106
378		48,628,748	33,022	5,329	256	2,066	0	1	11			107
967	9,027,982	54,250,996	95,163	15,358		5,636	0		13			108
013	27,692,680	22,677,210	775	0	11	174	0	0	1			109
162	24,542,386	522,127,162 (l)	302,328 (l)	36,952 (l)	2,783 (l)	25,110 (l)	12,249 (l)	38 (l)	8			110
805	75,079,781	588,970,211 (b, aa)	451,932	(c)	6	38,543 (aa)	3,834	14	15			111
			(j) 153,312									112
	26,887,637	24,971,108	11,683,485	107,488,765		0	48,621,418	0	56,976,311	44,213,276	67,472	12,82
	16,275,270	24,104,568	5,136,818	156,950,194		0	0	0	50,516,817	36,089,333	46,987	8,60

Power Corp. System.

(x) Includes only the Philadelphia Electric Co. and Delaware County Electric Co.

(y) Includes one consumer (3,048,172 kw.-hr.), company owned electric railway.

(z) Includes municipal street lighting.

(A) Includes surplus power interchange.

(B) Includes auxiliaries and excitation.

(C) Includes Metropolitan Edison Co., Pennsylvania Edison Co., New Jersey Power & Light Co. and their affiliated companies.

(D) Included under "other public utilities."

(E) Includes 193,295,959 kw.-hr. sales to affiliated electric companies, also sales to municipalities.

(F) Includes wholesale power.

(G) Included under "commercial lighting."

(H) Company sells power at wholesale only. No segregated classification.

(I) Includes Broad River Power Co. and the South Carolina Gas & Electric Co., the figures for the latter company being for the first seven months, at which time it was sold to the Southern Power Co.

(J) Includes 1,745,950 kw.-hr. sales to affiliated electric companies, also sales to municipalities.

(K) Includes 40,707,238 kw.-hr. delivered to Southern Power Co.

(L) Includes leased plants.

(M) Total of other than residential customers estimated at 6,500.

(N) Includes municipal and power customers.

(O) Includes retail power, 92,405,000 kw.-hr., 18,930 customers.

(P) Also 15,600 kw. by purchase; not specified whether hydro or fuel.

(Q) Pennsylvania-Ohio Power & Light Co. Includes municipal street lighting; 5,717,-822 kw.-hr.—68 customers. Pacific Gas & Electric Co. includes 30,442,586 kw.-hr. sold to street lighting customers.

(R) Deliveries to railway departments of company or used in affiliated street railway operations.

(S) Includes miscellaneous and unapportioned customers.

(T) Also 299,690 kva. available by lease or contract from 25 sources.

(U) Gross.

(V) Energy used in operation of plant, for construction work and in camp.

(W) Includes "electric railways."

(X) Rural.

(Y) Six plants three months, seven plants nine months.

(Z) Includes Pacific Gas & Electric Co. System, Western States Gas & Electric Co. (Stockton, Richmond and Eureka) and Coast Valleys Gas & Electric Co.

(aa) Also 2,643 combination customers.

(bb) Also 42,450 kw. by purchase; not specified whether hydro or fuel.

(cc) Also four plants, 18,100 kw., by contract; not specified whether hydro or fuel.

(dd) Includes 60,805,820 kw.-hr., company railway system.

(ee) Includes 355,730 kw.-hr., company water system.

(ff) Includes Yuma Utilities Co. and Nevada-California Power Co.

(gg) Generated energy includes 340,169,-

| | | |

| | | |

250,937	365,609,500	(U) 365,609,500	0	0	0	0	0	0	0	0	
0	319,842,000	319,842,000	0	26,887,637	24,971,108	11,683,485	107,488,765	0	48,621,418	0	
0	289,073,000	0	289,073,000	16,275,270	24,104,568	5,136,818	156,950,194	0	0	0	
0	234,238,160	195,553,200	38,684,960	25,681,219	37,815,877	8,625,914	93,639,571	0	0	39,595,452	
0	185,904,592	122,364,800	63,539,792	9,165,512	9,909,003	5,173,873	96,335,329	0	0	28,123,316	
0	168,960,000	41,068,000	127,892,000								
0	166,244,000	166,169,000	75,000	14,038,153	38,721,226	5,621,240	36,208,118	0	0	51,056,434	
845,697	4,797,215,720	3,666,989,018	1,130,226,702								
0	399,543,412	367,513,842	32,029,570	24,801,103	32,420,137	12,549,343	219,600,835	0	2,049,481	23,550,663	
0	362,094,000	361,566,000	528,000	21,738,990	16,780,834	18,305,187	198,904,663	0	55,201,122	12,276,415	
340	355,707,000	252,269,000	103,438,000	24,588,491	17,061,465	18,964,896	176,030,230	0	21,508,378	30,518,869	
0	250,542,000	195,222,000	55,320,000	3,825,601	1,903,356	2,179,257	118,767,813	157,575	0	96,475,430	
0	241,723,000	222,578,000	19,145,000	9,705,254	10,679,009	5,600,523	67,150,801	0	1,462,400	103,450,553	
9,825	183,843,000	107,409,000	76,434,000	10,757,377	18,278,125	7,614,763	73,725,528	0	667,260	20,659,132	
0	171,925,970	170,213,490	1,712,480	20,336,844	24,484,079	10,919,230	61,387,141	0	41,653,154	673,848	
0	155,783,691	155,734,941	48,750	7,156,947	8,508,064	3,709,138	93,835,585	0	4,239,730	23,403,052	
0	140,230,159	140,023,200	206,959	9,195,701	10,674,631	8,508,148	85,001,260	0	0	11,084,500	
0	135,199,859	90,605,352	44,594,507 (b)	23,274,247	(c)	5,575,359	62,674,942	543,961	(D)	(W) 14,348,907	
2,972	120,521,353	104,154,723	16,366,630	6,536,392	10,782,414	4,311,639	33,006,514	(X) 6,553,447	0	2,519,076	
14,932	2,517,113,444	2,167,289,548	349,823,896								
245,000	1,366,997,834	1,366,997,834	0	18,073,861	17,254,521	11,761,972	(k) 1,099,825,826	3,974,939	9,433,441	10,837,767	
188,847	784,402,000	615,158,000	169,244,000	36,340,105	34,779,646	12,046,596	523,054,193	0	53,487,476	1,052,623	
71,500	352,253,000	330,817,000	21,436,000	38,002,012	12,214,087	7,947,957	67,636,093	0	3,561,725	174,262,378	
32,687	285,892,553	280,448,746	5,443,807	31,078,971	45,649,151	8,682,334	121,144,772	0	421,380	15,636,967	
64,400	206,356,017	206,218,975	137,042	1,139,780	0	6,700,834	129,845,500	0	0	18,300,013	
702,087	2,995,901,404	2,799,640,555	196,260,849								
348,350	2,421,357,098	2,409,869,298	11,487,800	99,056,462	73,312,043	479,181,909	850,469,798	39,113,530	310,368,646	23,185,162	
463,425	2,322,015,035	1,566,646,081	755,368,954 (b)	278,377,270	(c)	(Q) 45,975,340	952,961,934	44,592,037	279,922,657	56,135,805	
244,574	1,351,590,977	1,180,851,704	170,739,273								
148,257	787,258,688	751,266,048	35,992,640	76,551,670	69,847,871	12,706,701	350,343,577	0	85,665,458	14,886,450	
163,750	633,019,740	624,627,940	8,391,800								
95,757	584,279,702	253,875,300	330,404,402	71,625,381	110,746,286		268,404,922	40,013,617	0	2,941	
81,980	495,663,700	493,072,300	2,591,400	45,769,814	24,152,956	20,384,003	174,647,990	14,626,824 (dd)	82,325,773	22,093,058 (ee	
57,888	374,724,290	374,409,730	314,560	22,145,964	10,000,216	1,308,188	54,625,686	0	0	215,634,514	
93,420	279,334,470	265,069,500	14,264,970	4,204,077	5,932,512	926,051	150,233,501	7,149,477	0	16,628,633	
86,900	277,591,025	263,239,025	14,352,000	64,082,748	43,689,316	10,126,133	53,069,157	0	38,580,808	0	
12,000	255,766,000	207,222,000	48,544,000	19,148,307	18,927,615	3,575,170	174,120,652	0	0	18,310	
0	247,191,413	247,142,687	48,726	50,593,758	73,914,093	1,878,884	71,282,934	0	0	0	
64,000	197,580,149	197,435,069	145,080	32,374,865	23,136,640	24,534,677	63,055,011	910,255	1,115,200	1,682,797	
21,682	171,611,000	125,214,000	46,397,000	23,171,686	13,574,960	4,722,419	57,336,781	0	2,640,776	33,398,910	
0	126,801,100	109,945,130	16,855,970 (b)	40,876,180	(c)	4,265,062	37,553.708	0	17,147,700	737,471	
2,081,207	10,525,784,387	9,069,885,812	1,455,898,575								
799,854	4,133,501,842	3,929,373,496	204,128,346								
411,350	3,021,201,950 (gg)	1,216,246,798	1,804,955,152	0	0	0	2,489,094,900 (gg)	340,169,958	0	0	
330,000	1,719,820,588	1,719,820,588	0	0	0	0	1,261,163,494	0	0	457,171,041	
223,010	1,354,895,244	936,313,545	418,581,699								
148,000	853,887,000	853,887,000	0				(hh) 735,387,000	(ii) 118,500,000			
75,000 (w)	604,597,700	604,597,700									
109,000	511,103,200	511,103,200	0	41,178,189	14,727,293	874,430	237,206,799	42,749,049	6,130,586	17,819,938	
84,700	476,999,100	476,999,100	0								
97,750	358,371,100	358,371,100	0 (kk)	110,260,273 (ll)	68,666,046	12,411,631	30,263,655	71,676,200	0	3,994,300	
113,325	350,402,700	350,402,700	0	32,628,818	40,239,946	4,868,289	104,486,862 (mm)	13,749,729	76,564,898	718,663	
61,375	305,415,945	305,415,945	0 (b)	7,197,552	(c)	486,616	251,113,468	0	935,600	57,772	
47,500	253,859,900	191,850,900	62,009,000			2,500,000			20,144,155		
54,450	213,670,326	213,670,326	0	204,000		59,632,484	49,591,204			84,385,111	
57,820	125,319,394	123,168,936	2,150,458	7,357,151	400,000	1,151,620	47,950,795	440,000	1,586,260	57,869,760	
26,500	104,071,000	104,071,000	0				89,453,524				
2,711,284	14,387,116,989	11,895,292,334	2,491,824,655								
154,060	606,245,844	606,245,844	0	16,215,615	15,211,255	37,157,751	301,390,005	11,930,803	80,082,274	962,408	
25,000	156,086,800	156,086,800	0	0	0	0 (h)	130,997,625	0	0	5,673,447	
0	1,103,063,438	1,102,407,030	656,408	0	0	0	52,636	0	202,458,160	55,313	
0 (rr)	577,710,827	0 (rr)	630,340,130	0	0	0	0	0	0	3,135,606	
0	544,081,653	544,081,653	0	0	0	0	0	0	504,546,457	0	
0	371,731,556	64,994,182	306,737,374	0	0	0	0	0	0	0	
0	307,432,390	264,185,040	43,247,350	0	0	0	0	0	0	0	
0 (ss)	243,925,965 (ss)	243,925,965	0								
0	222,131,354	222,131,354	0	0	0	0	47,051,407	0	22,380,700	0	
0	190,485,000	0	190,485,000								
0	189,691,700	134,160,600	55,531,100	0	0	0	7,009,000	0	20,030,100	0	
0 (tt)	148,560,111	0 (tt)	148,560,111								
16,000	137,695,684	70,360,010	67,335,674								
0	128,913,861 (uu)	46,795,801 (uu)	82,118,060	0	0	0	99,671	0	10,166,500	283,745	
0	123,759,732	104,318,267	19,441,465	0	0	0	0	0	0	0	
700	114,168,609	71,547,813	42,620,796								

0	56,976,311	44,213,276	67,472	12,823	60	2,405	0	2	0	88
0	50,516,817	36,089,333	46,987	8,606	188	3,074	0	0	0	89
52	3,374,407	25,505,720	70,891	11,157	247	3,475	0	0	3	90
16	13,092,751	24,104,808	36,769	13,609	.....	2,086	0	0	.....	91
..	.....	.....	11,714	2,565	.....	556	30	.....	1	92
34	.....	20,092,751	35,291	8,141	45	1,841	0	0	4	93
..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
63	6,436,992	78,134,858	73,733	17,503	410	5,490	0	3	29	94
15	.....	38,886,789	57,624	9,987	22	5,502	0	2	4	95
69	.....	67,034,671	69,340	18,756	484	4,248	0	3	18	96
30	.....	27,232,968	11,070	3,440	96	558	2	0	2	97
53	.....	43,674,460	24,385	7,275	152	1,841	0	1	7	98
32	.....	52,140,815	38,039	11,501	167	2,605	0	1	11	99
48	.....	12,471,674	51,128	6,737	233	2,071	0	1	1	100
52	5,063,125	19,868,050 (*i*)	28,444	(*c*)	(*c*)	(*c*)	0	(*c*)	(*c*)	101
00	.....	15,765,919	29,445	4,149	5	725	0	0	2	102
07	10,185,305	18,597,138 (*b*)	44,585	(*c*)	.....	3,028	.....	.....	.....	103
76	32,989,177	23,822,694	28,087	13,406	101	2,882	(*X*) 984	0	4	104
..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
67	(*g*)	(*h*) 195,835,507	36,633	8,817	435	(*k*) 2,414	1,529	2	14	105
23	.....	123,641,361	83,167	11,612	232	3,723	0	6	6	106
78	.....	48,628,748	33,022	5,329	256	2,066	0	1	11	107
67	9,027,982	54,250,996	95,163	15,358	.....	5,636	0	.....	13	108
13	27,692,680	22,677,210	775	0	11	174	0	0	1	109
..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
52	24,542,386	522,127,162 (*l*)	302,328	(*l*) 36,952	(*l*) 2,783	(*l*) 25,110	(*l*) 12,249	(*l*) 38	(*l*) 8	110
05	75,079,781	588,970,211 (*b, aa*)	451,932	(*c*)	6	38,543	(*aa*) 3,834	14	15	111
..	.....	..... (*j*)	153,312	.....	.....	.....	.....	.....	.....	112
50	4,958,049	172,298,912	105,335	18,527	20	7,284	0	6	11	113
.	.....	.....	.....	.....	.....	.....	.....	.....	.....	114
41	5,142,481	88,344,074	196,567	30,599	.....	11,806	.....	0	1	115
58	(*ee*) 2,941,052	108,722,230	84,085	8,316	441	2,740	191	8	19	116
4	3,662,750	67,346,972	15,626	3,515	61	881	0	0	8	117
83	2,013,850	92,246,369 (*b*)	19,432	(*c*)	77	2,407	2,709	0	13	118
0	2,067,228	65,975,635	75,083	8,280	2	2,478	0	1	0	119
0	.....	39,975,946	20,423	4,478	92	1,232	0	0	1	120
0	5,671,588	43,850,156 (*l*)	115,518	(*l*) 20,288	(*l*) 145	(*l*) 6,892	0	0	0	121
97	9,236,562	41,534,172	31,122	3,520	4	1,474	814	1	6	122
0	.....	36,765,468	37,350	7,674	71	3,630	0	3	4	123
71	5,909,816	20,311,163 (*b*)	60,398	(*c*)	22	3,741	0	1	3	124
.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
										125
0	6,896,318	185,041,584	0	0	0	.....	.....	0	0	126
1	.....	.....	0	0	0	.....	0	0	.....	127
.	.....	..... (*b*)	207,360	(*c*)	.....	5,482	.....	.....	.....	128
.	.....	.....	.....	.....	.....	2	1	.....	.....	129
										130
8	41,035,165	109,381,751	23,010	4,190	.....	1,170	540	.....	.....	131
.	.....	..... (*b*)	2,900	(*c*)	9	5	0	0	0	132
0	.....	61,098,995	58,221	6,806	3,515	1,002	2	0	2	133
3	5,818,401	71,327,094	60,087	11,852	.....	2,279	(*mm*) 16	.....	1	134
2	.....	45,624,937 (*b*)	8,693	(*c*)	9	38	0	1	1	135
.	.....	.....	9,120	3,500	4	600	.....	4	.....	136
1	.....	19,857,527	140	.....	2	6	.....	.....	2	137
0	1,495,920	7,067,888	.....	.....	.....	.....	.....	.....	.....	138
.	758,790	13,858,686	.....	.....	.....	41	.....	.....	.....	139
.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
8	.....	143,295,733	84,815	25,880	831	7,028	11,728	1	2	140
7	(*f*)	19,415,728	0	0	0	23	0	0	1	141
3	773,511,589	(*qq*) 126,985,740	0	0	0	.....	0	.....	.....	142
6	516,804,138	57,771,083	0	0	0	0	0	0	1	143
0	.....	39,535,196	.....	.....	.....	.....	.....	.....	.....	144
0	371,731,556	.....	0	0	0	0	0	0	0	145
0	307,432,390	.....	0	0	0	0	0	0	0	146
.	.....	.....	.....	.....	.....	.....	.....	.....	.....	147
0	149,812,854	2,886,393	.....	.....	.....	.....	.....	.....	.....	148
.	.....	.....	.....	.....	.....	.....	.....	.....	.....	149
0	156,962,600	5,690,000	0	0	0	10	0	1	0	150
.	.....	.....	.....	.....	.....	.....	.....	.....	.....	151
.	.....	.....	.....	.....	.....	.....	.....	.....	.....	152
5	107,269,948	11,093,997	0	0	0	4	0	6	.....	153
0	123,759,732	.....	0	0	0	0	0	0	0	154
.	.....	.....	.....	.....	.....	.....	.....	.....	.....	155

(*T*) Also 299,690 kva. available by lease or contract from 25 sources.

(*U*) Gross.

(*V*) Energy used in operation of plant, for construction work and in camp.

(*W*) Includes "electric railways."

(*X*) Rural.

(*Y*) Six plants three months, seven plants nine months.

(*Z*) Includes Pacific Gas & Electric Co. System, Western States Gas & Electric Co. (Stockton, Richmond and Eureka) and Coast Valleys Gas & Electric Co.

(*aa*) Also 2,643 combination customers.

(*bb*) Also 42,450 kw. by purchase; not specified whether hydro or fuel.

(*cc*) Also four plants, 18,100 kw., by contract; not specified whether hydro or fuel.

(*dd*) Includes 60,805,820 kw.-hr., company railway system.

(*ee*) Includes 355,730 kw.-hr., company water system.

(*ff*) Includes Yuma Utilities Co. and Nevada-California Power Co.

(*gg*) Generated energy includes 340,169,958 kw.-hr. hydraulic sales.

(*hh*) Primary power.

(*ii*) Secondary power.

(*jj*) Includes Manitoba Power Co., Ltd.

(*kk*) Includes 21,220,761 kw.-hr. residence lighting, 89,039,512 kw.-hr. residence heating.

(*ll*) Includes 32,938,055 kw.-hr. commercial lighting 35,727,991 kw.-hr. commercial heating.

(*mm*) Street lighting.

(*nn*) Also one leased hydro plant, 10,000 kva.

(*oo*) Includes Ottawa River Power Co.

(*pp*) Horsepower.

(*qq*) Includes energy used by powerhouses, shops, yards and by substation auxiliaries.

(*rr*) Energy purchased measured on a.c. side, output measured on d.c. side.

(*ss*) Converted a.c. measured on d.c. side; plus generated d.c.

(*tt*) Energy consumed.

(*uu*) Energy generated to May 10; purchased there after. (Missouri River plant sold to Kansas City Power & Light Co., May, 1927.).

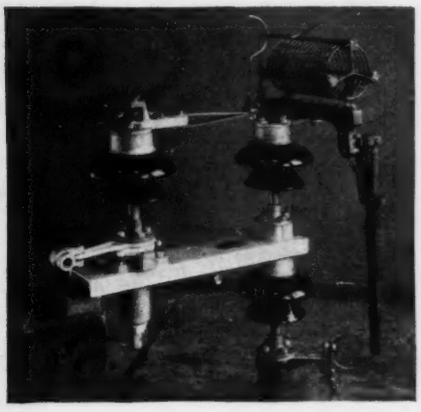
(*vv*) In numerous instances, of which it has not seemed necessary to make individual mention, company reports indicate that figures for "commercial lighting" also include small power sales. Similarly "Power" sales include some energy at wholesale for lighting.

(*ww*) A number of companies have included under this heading one or more of the following items: Street Lighting, Municipal, County, State and Federal Buildings, Municipal Power. In some instances energy sold to municipalities for resale is also included.

New Equipment Available

Switching and Protective Unit for Rural Service

A switching and protective unit that consists of an air break switch, a choke coil and a fuse which can be used on systems where the short-circuit currents may run as high as 5,000 amp. has been developed by the Hi-Voltage Equipment Company, Cleveland. The unit is intended for rural service or small industrial substations. The switch is built with monel ball bearings that do not require any lubrication. The bearing spindle which carries the operating insulator is a machined steel forging. Only three insulators, as shown in the illustration, are used to carry the switch, choke coil and fuse. Six standard types of mounting are provided. The switches are available for voltages from 10,000 to 40,000.



Rural service switch combined with protective unit

Air Filters

An air filter which can be inserted in air pipe lines and which it is claimed will remove dust, water, oil, rust, scale and other foreign matter from air passing through the pipes has been placed on the market by the Staynew Filter Corporation, Rochester, N. Y. The filter consists of an aluminum housing inclosed in a pressed steel housing, which the manufacturers claim will withstand a working pressure of 125 lb. The filter mounted inside consists of a felt filter medium formed in pockets over radial wire screen fins grouped around a central outlet.. This permits mounting a relatively large area of felt in a compact space. The large capacity inserts are designed to pass 250 cu.ft. of free air per minute and contain 20 sq.ft. of felt within a volume slightly smaller than a cubic foot. Cleaning is accomplished by reversing the air flow.

Another type of filter used in filtering large volumes of air is of similar construction mounted in heavy compressed-steel frames. The filter can be cleaned by a special air suction cleaner. The manufacturers claim that it can be operated under ordinary conditions for several months before cleaning is necessary.

Electrolysis Drainage Valve

The "Kuprox" electrolysis drainage valve for safeguarding against reverse currents, which cause electrolysis and chemical decomposition of underground metallic structures, has been developed by the Kodel Electric & Manufacturing Company, Cincinnati, Ohio. These drainage valves have no contacts or moving parts, are said to require no attention and will function indefinitely. Arranged for either pole or manhole installation and built in capacities up to 1,000 amp., the Kuprox (copper oxide) valve is said to be adaptable to any and all conditions where vagabond electric currents from grounded electrical distributing systems are causing decomposition of underground cables.

Potential Transformer Fuse and Wire Wound Resistor

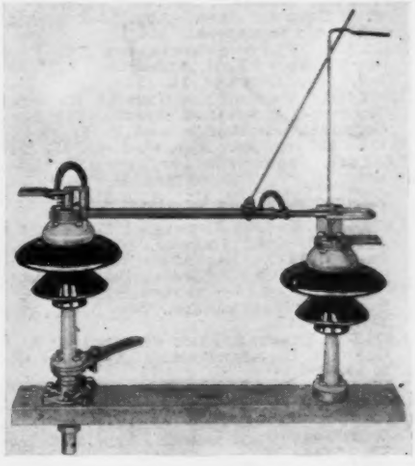
The type H combination potential transformer fuse and wire wound resistor for 2,500 to 25,000-volt service has been placed on the market by the Westinghouse Electric & Manufacturing Company. It is intended for indoor application and can be mounted on any flat surface or upon 1¼-in. pipe. The resistors are placed in series with the fuses and are said to limit effectively the current in case of short circuit. This permits the use of potential transformer fuses on any circuit regardless of its short-circuit amperes, provided the voltage rating of the system is not more than that of the fuses and resistors.

The resistors are made up of coiled nichrome wire wound in the grooves of a heavy wet-process porcelain tube. They are combined with fuse, fuse mountings and insulators. The resistor may be mounted either in line with or perpendicular to the insulators.

PRIMARY-RESISTANCE DRUM SWITCHES.—A new line of primary resistance drum switches for use with squirrel-cage induction motors on small cranes, hoists, machine tools, etc., has been announced by the General Electric Company. It is a primary reversing switch designed for wall mounting and can be furnished with a standard conduit box. It is made in two forms, CR-3200-1250-B, for hoists where the motor is overhauled in the lowering direction, and CR-3200-1250-A, for hoists where the motor is not overhauled in the lowering direction. The switches are built without operating mechanism so that the user may select the type of operating equipment he desires. The switches are designed for operation on maximum primary voltages of 550 and the maximum horsepower rating for two- or three-phase service is 15.

Two-Insulator "Hi-Pressure" Contact Switch

A complete line of type "A" switches, as shown in the illustration, has been developed by the Railway & Industrial Engineering Company, Greensburg, Pa., up to 154 kv. The blade revolves on a rotor bearing, and in closing the toggle end strikes the stop and straightens out, sliding the contact surfaces into closed position. The final sliding movement takes place under high pressure, which the manufacturer claims removes all dirt, ice and corrosion. They are built for either air-break or disconnecting purposes.



"Hi-Pressure" contact switch of the two-insulator type

Gasoline-Engine-Driven Welding Outfit

A 300-amp. gasoline-engine-driven welder, known as Model S-1964, has been placed on the market by the Lincoln Electric Company, Cleveland. The welding generator is rated at 300 amp. in accordance with N.E.M.A. standards and has a current range of from 75 to 400 amp. for metallic electrode welding. It is direct connected to a six-cylinder Buda Model HS-6 engine, operating at 1,500 r.p.m. Both units are mounted on a welded steel base. The generator has a laminated magnetic circuit with separately excited field, stabilizer, variable voltage and steel construction features of the company's line of "Stable-Arc" welders. The over-all dimensions are 93 in. long, 35 in. wide with an over-all height of 45 in. The equipment has been designed to meet the constantly increasing use of larger electrodes in welding, and the six-cylinder performance gives a smooth, even flow of power, so necessary for successful welding.

Electrical Patents

Announced by U. S. Patent Office

(Issued June 5, 1928)

1,672,302. SIREN-CONTROL SYSTEM; H. S. Campbell, Hammond, Ind. App. filed Dec. 22, 1922.

1,672,312. ELECTRICAL FIXTURE UNIT; S. N. Griffith, Doylestown, Pa. App. filed Aug. 21, 1923.

1,672,314. FRICTION BRAKE; J. H. Hall, Cleveland Heights, Ohio. App. filed Oct. 5, 1925. Of the spring-applied and electromagnetically-released type.

1,672,324. WIRE-THREADING LEADER AND COUPLER; C. H. Kepler, Oakland, Calif. App. filed Oct. 23, 1925. To facilitate the passing of wires through conduits.

1,672,357. JOINT FOR ELECTRIC CABLES; J. F. Watson, Abbey Wood, England. App. filed Oct. 29, 1927.

1,672,365. ELECTRIC SWITCH; G. A. Burnham, Saugus, Mass. App. filed July 25, 1921. Oil immersed.

1,672,402. PLATING APPARATUS AND PRODUCT THEREOF; E. R. Armstrong, Hollyoak, Del. App. filed Oct. 14, 1924.

1,672,410. METHOD FOR TESTING RAILWAY-TRAFFIC-CONTROLLING APPARATUS; L. O. Grondahl, Pittsburgh, and P. H. Geiger, Wilkinsburg, Pa. App. filed Jan 18, 1926.

1,672,476. PROTECTING APPARATUS FOR LINEMEN; M. T. Tipsord and H. W. Bodendieck, Taylorville, Ill. App. filed Jan. 30, 1926.

1,672,494. SWITCH-OPERATING MECHANISM; A. F. C. Lotz, Chicago, Ill. App. filed June 1, 1925. Mechanism for closing an oil switch and for tripping the same open.

1,672,509. REEL FOR ELECTRIC IRONS; B. F. P. Vedder, Milwaukee, Wis. App. filed Nov. 11, 1926.

1,672,521. ELECTRIC PLUG CONNECTER; A. R. Goldrick, Cleveland, Ohio. App. filed Dec. 1, 1921.

1,672,556. TWO-LIGHT PLUG; T. A. Both, Stratford, Conn. App. filed June 13, 1924.

1,672,592. STERILIZING APPARATUS; D. G. Will, Fort Wayne, Ind. App. filed Nov. 17, 1924.

1,672,620. COMBINATION FUSE AND PLUG; W. B. Moss, Jr., and M. L. Ardisana, Evanston, Ill. App. filed June 14, 1926.

1,672,664. TWIN-LIGHT PLUG; O. H. Van Amburg, Bridgeport, Conn. App. filed Nov. 21, 1922.

1,672,667. ELECTRIC FURNACE; H. L. Watson, Lynn, Mass. App. filed Nov. 13, 1926. High temperature.

1,672,669. CONSTANT CURRENT TRANSFORMER; T. G. Whyte, Lynn, Mass. App. filed Aug. 13, 1925. Of the movable coil type.

1,672,670. ELECTRIC MOTOR-CONTROL SYSTEM AND APPARATUS; M. Wilfart, Paris, France. App. filed July 17, 1924. For use in operating machines having widely varying load characteristics such as rolling mills and the like.

1,672,674. REGULATING SYSTEM; R. M. Carothers, Schenectady, N. Y. App. filed June 24, 1926. Voltage regulating.

1,672,680. DYNAMO-ELECTRIC MACHINE; E. H. Freiburghouse, Schenectady, N. Y. App. filed April 21, 1925. Ventilating system.

1,672,683. OUTLET OR JUNCTION BOX; H. G. Knoderer, Englewood, N. J. App. filed June 4, 1921.

1,672,685. COMMUTATOR; G. Lewinnek, Berlin, Germany. App. filed Jan. 4, 1926. Double commutator.

1,672,690. CONTROL SYSTEM AND APPARATUS FOR ELECTRICAL DEVICES; C. C. Runner, Schenectady, N. Y. App. filed Aug. 6, 1924.

1,672,693. EXPANSION JOINT; R. C. Scott, Cambridge, Mass. App. filed June 1, 1925. For buses employed in high voltage power or switching stations for the transmission of electrical energy.

1,672,702. WELDING APPARATUS; J. M. Weed, Schenectady, N. Y. App. filed Dec. 11, 1923.

1,672,703. INDUCTION VOLTAGE REGULATOR; H. R. West, Pittsfield, Mass. App. filed Sept. 23, 1927.

1,672,706. METHOD OF MAKING CONTACT TIPS; W. W. Brown, Erie, Pa. App. filed Jan. 13, 1926. Of drum controllers or other switch mechanism.

1,672,714. NONAQUEOUS ELECTROLYTIC CONDENSER; E. W. Engle, Lake Forest, Ill. App. filed Aug. 29, 1927.

1,672,724. ELECTRIC OVEN; F. H. McCormick, Glen Ellyn, Ill. App. filed Oct. 18, 1926.

1,672,725. ELECTRIC HEATER; F. H. McCormick, Glen Ellyn, Ill. App. filed Oct. 1, 1927.

1,672,727. ELECTRIC SWITCH; A. H. Nero, West Hartford, Conn. App. filed Feb. 15, 1926.

1,672,729. MAGNETIC CUT-OUT PLUG; C. Pape, Berlin, Germany. App. filed Nov. 5, 1925.

1,672,777. REGULATING APPARATUS; D. C. Prince, Schenectady, N. Y. App. filed March 13, 1926. For the transmission of current between alternating and direct current circuits.

1,672,791. ELECTRICAL SWITCH; W. S. Thimblethorpe, London, England. App. filed Aug. 21, 1926. Two-way delayed action switch useful in signaling work and apparatus.

1,672,800. ELECTRIC CUT-OUT FOR STILLS AND THE LIKE; L. F. Boss, Woods Hole, Mass. App. filed May 12, 1926.

1,672,802. DEVICE FOR RESETTING POWER-DRIVEN MECHANISM TO A PREDETERMINED POSITION; M. Chirol, Bourg-La-Reine, France. App. filed Nov. 19, 1926.

1,672,809. ELECTRIC IRON AND STAND; W. P. Haynie, Philadelphia, Pa. App. filed Oct. 5, 1925.

1,672,821. SUBMARINE CABLE CORE AND INSULATION THEREFOR; C. Martell, Cicero, Ill. App. filed Oct. 7, 1924.

1,672,847. ELECTRICAL POWER SYSTEM; J. J. Kane, Milwaukee, Wis. App. filed April 19, 1921. Device for regulating generators driven by prime-movers, to supply variable loads, especially where there is a tendency for the generator-driving means to operate at a speed dependent upon the load.

1,672,859. INTERMITTENT-CURRENT DEVICE; J. W. Phelps, Chicago, Ill. App. filed March 11, 1925. Make and break or flashing device.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Johannesburg, South Africa (No. 31,758), for batteries for radio and flashlights, household electric equipment and cable insulated wire.

Purchase and agency are desired in Calcutta, India (No. 31,764), for electric fans, incandescent lamps, sockets, switches, etc., and small motors.

An agency is desired in Port Elizabeth, South Africa (No. 31,761), for flashlights and cable insulated wire.

An agency is desired in The Hague, Netherlands (No. 31,760), for household electric equipment.

An agency is desired in Barbados, West Indies (No. 31,754), for small hydro-electric generator sets.

Purchase is desired in São Paulo, Brazil (No. 31,757), of electric motors and small steel furnaces.

Purchase is desired in Sydney, Australia (No. 31,755), of fractional horsepower motors.

An agency is desired in London, England (No. 31,811), for portable electric bakers' and confectioners' ovens.

Purchase and agency are desired in Oslo, Norway (No. 31,762), for sewing machine motors, electric vacuum cleaners, washing machines and wringers.

Purchase is desired in Huddersfield, England (No. 31,759), and in Halifax, England (No. 31,763), of traffic-control devices.

Purchase is desired in Hamburg, Germany (No. 31,756), of electric welding machines.

An agency is desired in Algiers, Algeria (No. 31,753), for X-rays and ultra-violet rays apparatus.

Copies of a tender for the supply of transformers and switchgear for a new pre-cooling plant which is now being erected in Durban by the South African Railways and Harbors have been received (EE 1076). The closing date is July 12, 1928.

The Porto Rico Railway, Light & Power Company, San Juan, will begin work on the Rio Blanco power project, to cost $800,000. J. R. McKey, San Juan, P. R., Assistant Trade Commissioner.

An agency is desired by Remy Armbruster Jun., Basel 1, Switzerland, for motors and industrial heating equipment.

New Trade Literature

APPARATUS FOR BURNING PULVERIZED FUEL.—Catalog U-3 describing the "Lopulco" unit system for burning pulverized fuel by the direct-fired method has been issued by the Combustion Engineering Corporation, 200 Madison Avenue, New York City. The construction and operation of the mills used in the system are described and illustrated. Line diagrams of the applications of the "Lopulco" unit system to various types and sizes of boilers are included. It also contains illustrations covering the various types of horizontal, vertical and tangential burners used with the system.

RELAY AND TEST BLOCKS.—The General Electric Company, Schenectady, N. Y., has issued bulletins GEA-943 and GEA-949 covering respectively polyphase induction power-directional relays and temperature overload relay panels for use with hand compensators. The company also is distributing bulletin GEA-900, which describes and illustrates its type PK-1 test blocks and plugs for switchboard-mounted meters, instruments and relays.

AIR COMPRESSOR.—Bulletin No. 140 issued by the Pennsylvania Pump & Compressor Company, Easton, Pa., describes its multiple-belt-driven semi-portable air compressor unit arranged for automatic start and stop control.

ALLOY STEEL. — The International Nickel Company, Inc., 67 Wall Street, New York City, is distributing bulletin No. 12, which contains information on the use of alloy steel for boiler construction.

MOTOR DRIVES FOR WOOLEN CARDS AND MOTORS.—The General Electric Company, Schenectady, N. Y., has issued bulletin GEA-967 covering its types FTR and FQR squirrel-cage and types MT and MQ wound-rotor motor drives for woolen cards. The company is also distributing bulletin GEA-166A describing its alternating-current, open or inclosed crane and hoist motors.

OIL PURIFIER.—The De Laval Separator Company, 165 Broadway, New York City, has issued a bulletin which covers the new No. 700 portable De Laval insulating oil purifier. It contains information on the construction of the oil purifier and shows how it is used.

REFRIGERATORS.—"Modern Refrigeration in the Modern Color Setting" is the title of a booklet issued by the Servel Sales, Inc., 51 East 42d Street, New York City. It discusses in detail the modern color idea, particularly as applied to the kitchen.

GENERATING AND OIL-TESTING SETS. — The General Electric Company, Schenectady, N. Y., is distributing bulletin GEA-781A describing and illustrating the steam-engine-driven generating sets for marine service. The company also has issued bulletin GEA-832 covering its portable oil-testing sets.

CONDUIT ACCESSORIES.—The Cleveland Wrought Products Company, West 58th Street and Denison Avenue, Cleveland, is distributing a circular covering its electrical conduit accessories, including lock nuts, pipe clamps and conduit bushings.

CHAIN DRIVE, POWER TRANSMISSION EQUIPMENT, ETC.—The Link-Belt Company, 910 South Michigan Avenue, Chicago, has issued a catalog and engineering data book, No. 500, which covers the complete chain, sprocket, power transmission, elevating and conveying and engineering divisions of the company's business and contains information of practical use to the engineer. Complete price lists also are included.

OUTDOOR STATION EQUIPMENT, SWITCHES AND ELECTRIC FURNACES.—Bulletins GEA-782, GEA-403A, GEA-939, GEA-979 and GEA-972 issued by the General Electric Company, Schenectady, N. Y., describe and illustrate respectively its weatherproof switch houses with manually operated oil circuit breakers for outdoor station equipment, the CR-900 reversing and non-reversing drum-type switches, disconnecting switches for indoor service, the CR2960-SY104A and SY103A control circuit switches and the GE pot-type electric furnaces for cyanide hardening.

STARTER. — The Allen-Bradley Company, Milwaukee, has issued bulletin No. 648 covering its resisto-transformer starter, a new starter for squirrel-cage motors. The bulletin contains illustrations, wiring diagrams and a complete description of the starter.

JUL 2 1928

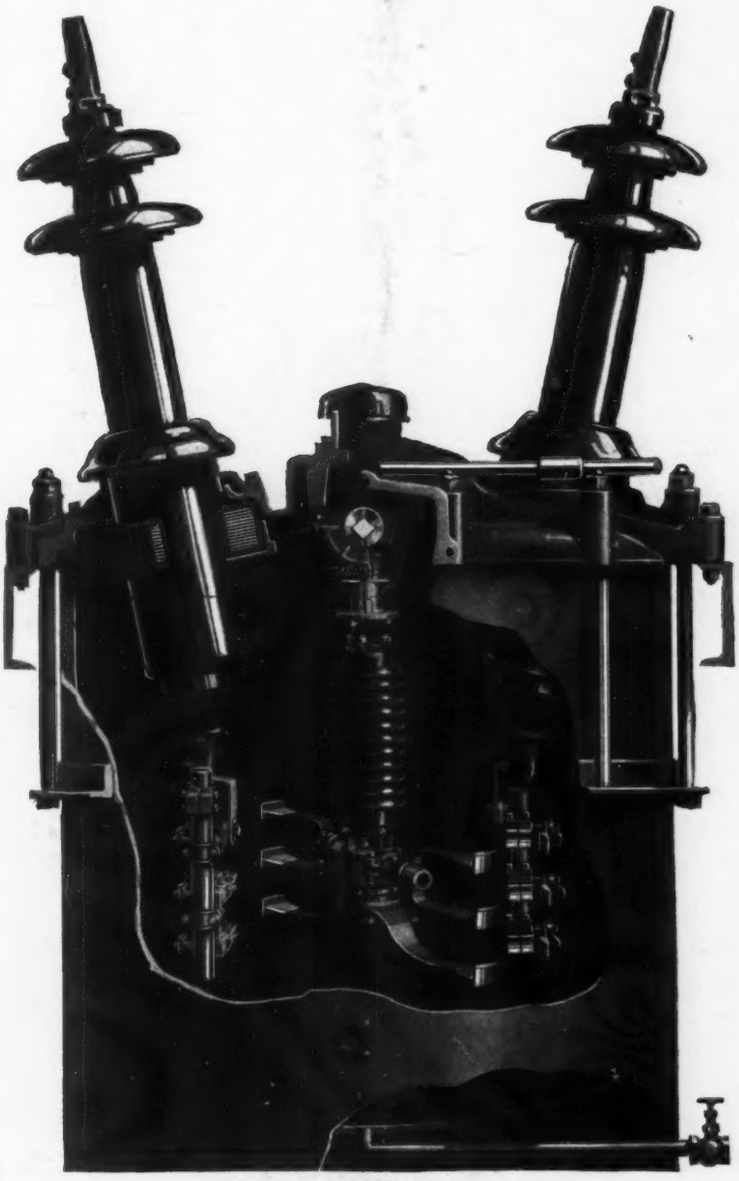
Founded 1874—Fifty-Four Years of Service

Electrical World

McGraw-Hill Publishing Company, Inc. JUNE 30, 1928 Twenty-five Cents Per Copy

Six breaks per phase in series with no added supporting insulation.

Horizontal breaks which draw arcs through oil away from their natural course.



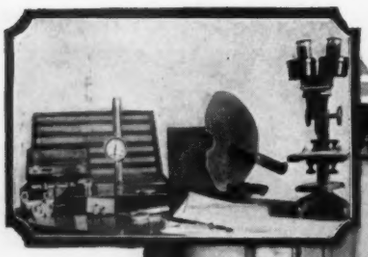
Concentric rotating elements with low inertia, low axial speed and high blade speed.

Full floating self aligning contacts and oversize arcing tips that are easily renewed.

Pacific Electric Six Break Oil Circuit Breaker.

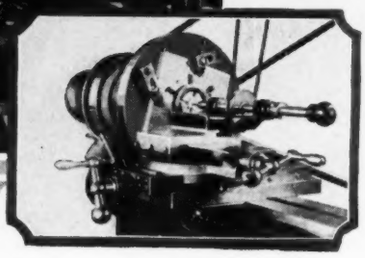
Pacific Electric Manufacturing Corp.

5815 THIRD STREET, SAN FRANCISCO, CALIF.



A group of inspection gauges and special tools typical of countless developments required to maintain extreme accuracy.

A Section of the Tool Department



Grinding one of the many sectional dies which calls for extreme accuracy. Wheel used, about .050" charged with diamond dust

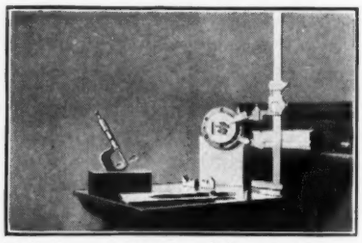
How Weston Instruments Get Their Start in Life

VITAL precision parts of a "Weston" are made in the Weston factory, from Weston-made tools, under one control and one *combined* engineering and manufacturing supervision.

Before this the design itself was begotten by craftsmen possessing the longest and most comprehensive technical and mechanical experience found in any industry contributing to the art of electrical measurement.

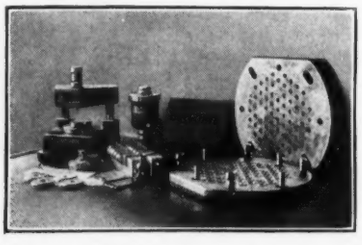
Thus, a Weston instrument is the product of one organization mind and properly enters upon its long and useful career in the Weston Tool-Making Department—*a veritable cradle of accuracy.*

The many thousands of minute parts required in the construction of hundreds of Weston models—the extreme refinement and close tolerances everywhere exacted in order to effect perfectly coordinated assemblies—and the high standards of performance established for machine tool operation—all these considerations call for the highest attainable skill in the tool-making art.

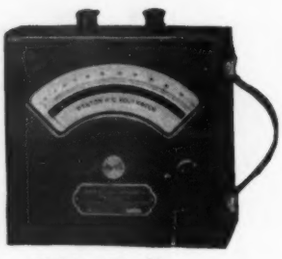


Preliminary inspection before hardening. *All tools receive numerous inspections during manufacture to insure the highest standard of accuracy.*

Completed tools—*pillar press die, sub-press die, bakelite mould, fixture, etc.* — *typicall of more than 30,000 special tools designed to meet the exacting requirements of Weston instrument parts.*



Tool-making, and all accompanying methods of machine control relating to small parts manufacture, thus represents the fundamental structure of Weston accuracy. There are no vital parts of uncertain origin to cause latent defects in construction. With this kind of a start constitutional weaknesses leading to premature old age are entirely obviated in a "Weston." You can depend upon one—and upon all.



Model 155 Portable A. C. Instruments

Model 45 Portable D. C. Instruments

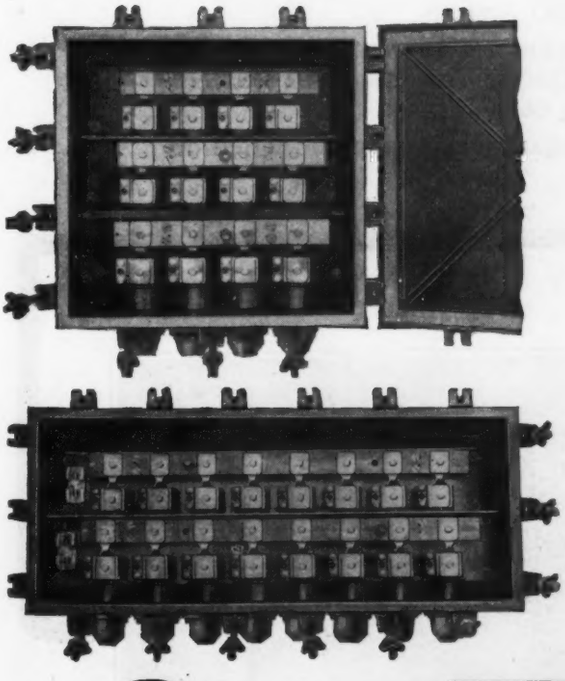
WESTON ELECTRICAL INSTRUMENT CORPORATION
578 Frelinghuysen Ave. Newark, N. J.

Weston
PIONEERS SINCE 1888
INSTRUMENTS

A Substantial Subway Fuse Box for Large Cables—

TYPE FB BOX

Bottom Cable Entrance



Type FB Box accommodates a great many large size cables in a small space, fitting in ideally with certain manhole conditions. The cables enter at bottom of box and each is sealed independently under compound, in unit heads, which prevents leakage of cable oil. Cables may be added or removed without disturbing rest of installation.

Type FB Box can be mounted near ceiling of manhole making it readily accessible in a manhole containing water. Each box is air tight and submersion proof. They are air-tested at factory.

Type FB Box is made for link fuses. They can be by-passed with jumper and plugs during fuse replacement.

Additional features: contact block easily renewable. Phases or polarities separated with insulating partitions. Buses are reversible, when one side becomes pitted, bus can be turned over. Heavy, rugged construction. Hinged wing bolts make interior easily accessible. Ample safety factors.

Type FB Box made for A.C. and D.C. 250 volt circuits, in 4, 6 and 8 ways accommodating as many as 16—2000 MCM cables in very small space.

G & W Electric Specialty Co.
7780 Dante Ave., Chicago, Ill.

G&W ELECTRIC SPECIALTIES

G&W

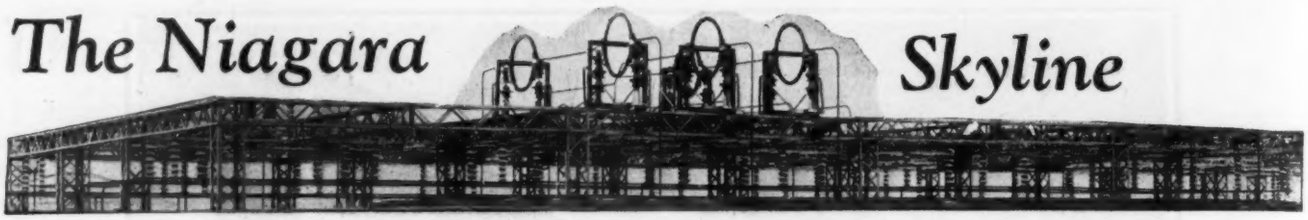
Exactly What You Want!

G & W design and manufacture practically every device for the end of a cable. See Catalog No. 27.

More than Protection for the Cable Ends

POTHEADS AND BOXES

The Niagara Skyline



LIGHTHIPE has 57

Not 57 varieties.

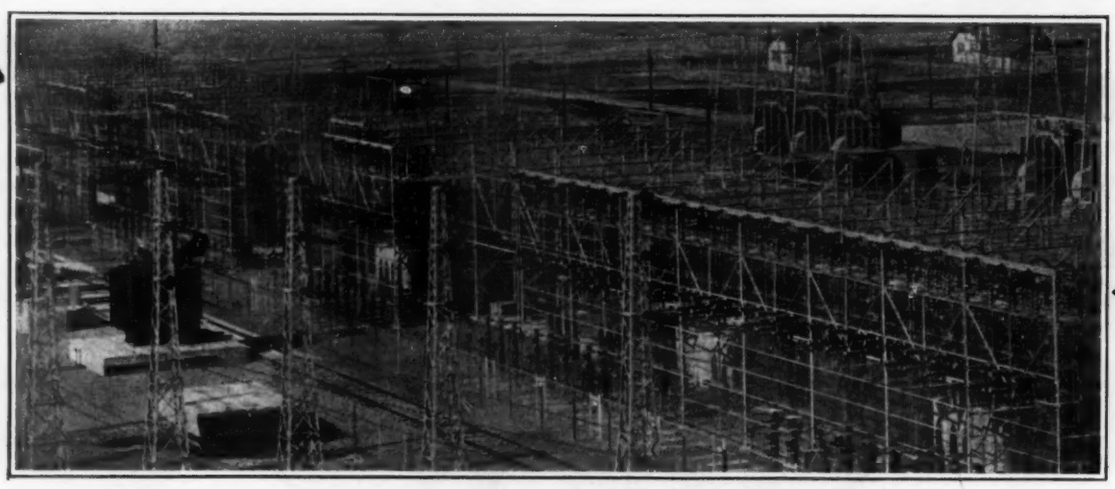
But 57 *identical* Niagara Transformers.

Identical in accuracy—a feature for which Niagara's are selected.

Lighthipe is the Southern California Edison Company's newest transmission center and the present terminus of the 220-Kv. transmission system.

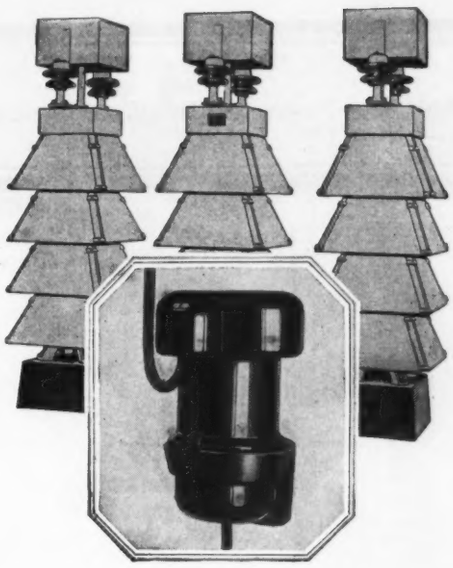
On the skyline of this station are the familiar Niagara rings—57 Niagara High Voltage Air Insulated Current Transformers on outgoing 66 Kv. lines.

Bulletins and data on Niagara Transformers mailed on request.



NIAGARA ELECTRIC IMPROVEMENT CORPORATION

Lee Skipwith & Co., Inc., General Sales Agents, 369 Lexington Ave., NEW YORK, N. Y.



TO JUDGE the success of any type of lightning arrester, you must consider the history of a great many installations. Oxide-film arresters for twelve years have been giving protection, in thousands of installations, in many different countries, and at all commercial voltages up to 220 kv., fulfilling every requirement of lightning protection on present-day systems.

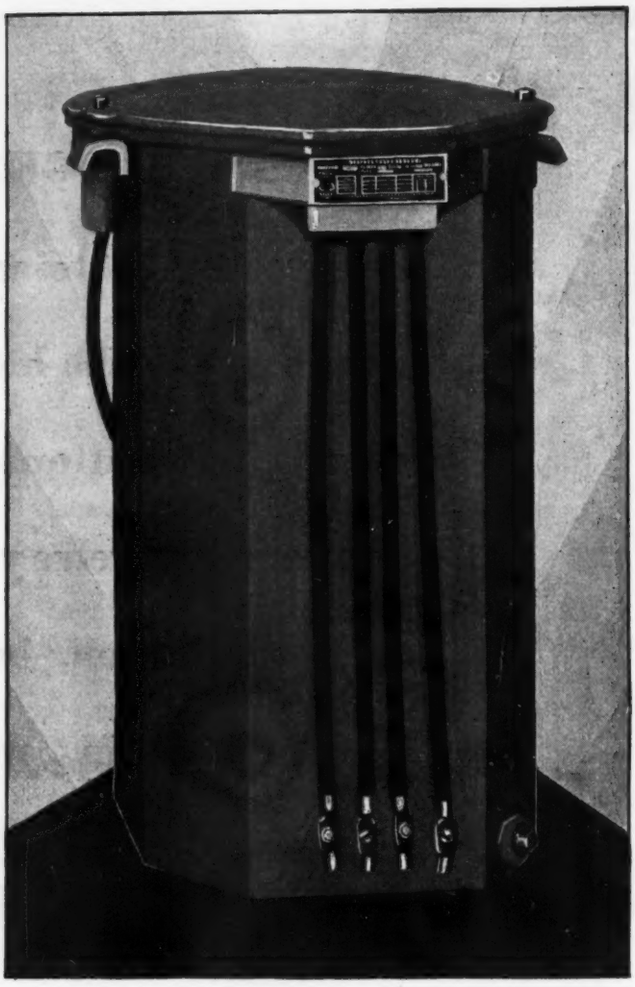
440-8

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

PRODUCTS

MOTORS—Single, Polyphase and Fynn-Weichsel Motors TRANSFORMERS—Power, distribution and instrument
FANS—Desks, Wall and Ceiling types



Style of sheet steel case with plain high-voltage bushings, for ratings of from 1½ to 37½ kva. inclusive.

HEAVY STEEL TANKS

—the better to withstand rough handling, rust and corrosion.

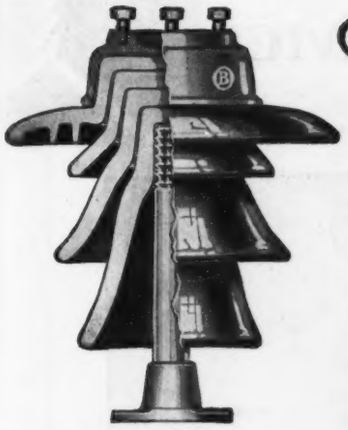
The Tanks of all Wagner Distribution Transformers are of heavy gage steel, electrically welded, either plain, with radiating tubes or corrugated depending upon the rating. The great mechanical strength of these Tanks is a protection against damage in handling and erection.

Copper-bearing sheet steel is the material used for Tanks of Wagner Transformers up to and including 100 kv-a., 13,800 volts. This type of steel affords maximum resistance against rust and corrosion. You can't go wrong if you put your trust in Wagner Distribution Transformers.

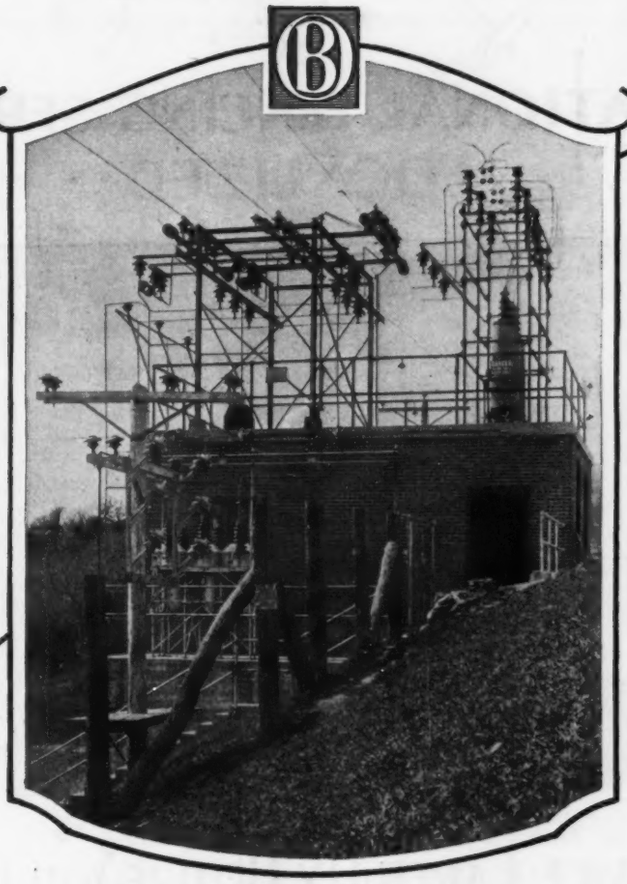
Ask for Bulletin 148

6737-6

WAGNER ELECTRIC CORPORATION—6400 Plymouth Avenue—St. Louis, U. S. A.



No. 26024
Four-piece Switch and Bus Insulator, general rating 66-kv., single unit; 135-kv., two-unit stack; 200-kv., three-unit stack.



No. 26440
Three-piece Switch and Bus Insulator, general rating 44-66-kv., single unit; 110-kv. two-unit stack.

Where the Requirements Are Most Severe

TO design insulators for switch and bus installation is an involved matter—for such insulators must combine high mechanical reliability, maximum electrical efficiency, and long life. However, unequalled facilities and O-B quantity production make possible the delivery of these three important characteristics in O-B Switch and Bus Insulators.

To compensate for thermal stress—thus providing against cracking—and to obtain in assembly an extremely refined degree of accuracy—an essential of complete interchangeability — are very important considerations in switch and bus insulator selection. Consequently, the discussion of proposed installations with O-B engineers, *at the time when plans are being made,* is highly desirable.

Your consideration, or selection of O-B Insulators for switch or bus installation can well be influenced by their endorsement and use by leading power companies the world over.

Ohio Brass Company, Mansfield, Ohio
Canadian Ohio Brass Co., Limited
Niagara Falls, Canada
882H

Ohio Brass Co.

NEW YORK CHICAGO PHILADELPHIA PITTSBURGH ST. LOUIS ATLANTA SAN FRANCISCO CLEVELAND LOS ANGELES

PORCELAIN INSULATORS
LINE MATERIALS
RAIL BONDS
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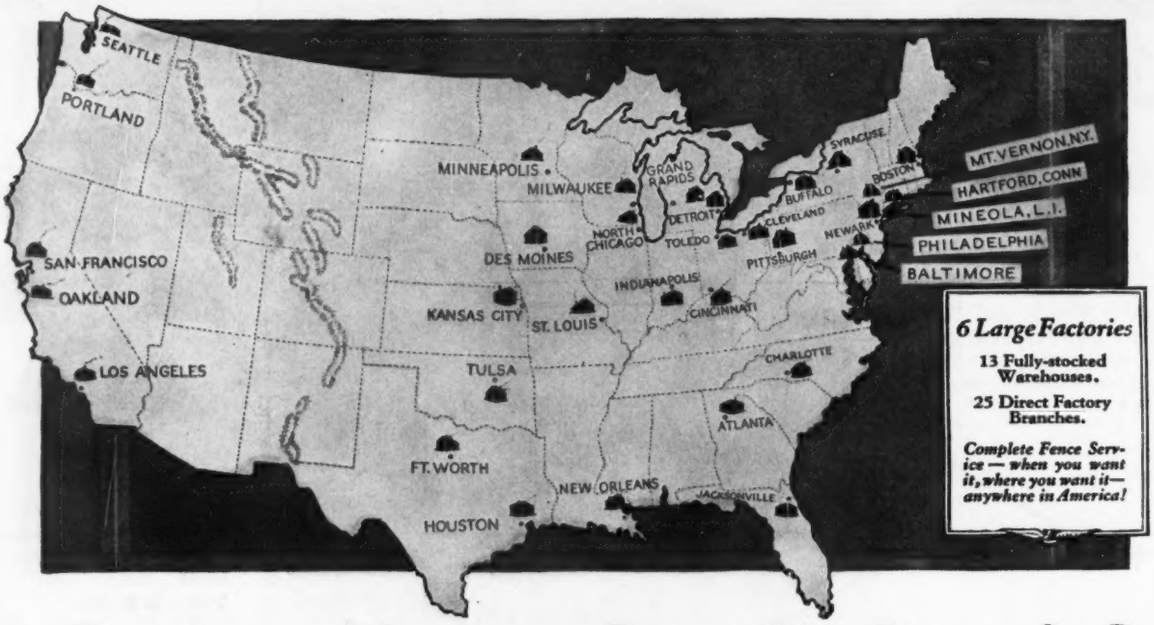
A NATIONAL FENCING SERVICE
··LOCALIZED··



WEIGH THIS SERVICE CAREFULLY BEFORE YOU DECIDE ON PRICE!

Cyclone Service is an institution that has been in the making for over 31 years. It is national in scope, yet so completely organized that every phase of this service is available at the most obscure point on the map.

Experienced sales representatives are available for consultation at all Cyclone factories and at 25 direct factory branches. More than 100 skilled Cyclone erection crews are stationed at these plants and branches — installing fence in surrounding territory, and covering collectively the entire country.

To complete the Cyclone national network of service, Cyclone maintains fully-stocked warehouses at convenient points for quick shipment to any locality.

The Cyclone Fence Company sells you not simply so many feet of fence but the finished installation. Cyclone never sublets any part of the work but accepts Complete Responsibility. That means proper erection, longer fence life, actually lower per-year cost.

Near you there is a Cyclone representative. Call him in, compare fence values. Weigh Cyclone Specifications and Service carefully before you decide on price.

Write, phone or wire nearest offices without obligation.
Day or night, we're ready to serve you.

Cyclone Fence
REG. U.S. PAT. OFF.

Fencing for residences, estates, schools, playgrounds, factories, property of all kinds.

CYCLONE FENCE COMPANY *Main Offices:* Waukegan, Ill.
Works and Offices: North Chicago, Ill., Cleveland, Ohio, Newark, N. J., Fort Worth, Texas
Pacific Coast Division: Standard Fence Co., Oakland, San Francisco and Los Angeles, Calif., Northwest Fence & Wire Works, Portland, Ore., Seattle, Wash.
Direct Factory Branches in all Principal Cities.

Modern deductions from age old adages!

All that glitters is not g.

Iron pyrites, for instance, glitters like gold—
—sometimes looks better

—but you notice the difference when you come to work it
—and it rusts quickly.

And similarly you'll see plenty of standard items of pole line hardware that look like Oliver items.

But you quickly notice the difference when you come to work the nuts—

—or when you expose them to the elements for a time. An Oliver galvanizing development* assures free running threads and the greatest protection against rust.

*The Fassinger Process

THREADS

A lot of them on this

OLIVER

Drop Forged Double Arming Eye Bolt

Threaded within two inches of the eye.

Furnished with three square nuts. Think what advantage the Fassinger Process gives on such an item. The lineman knows.

(See page 8, Oliver catalog)

Get your quotation

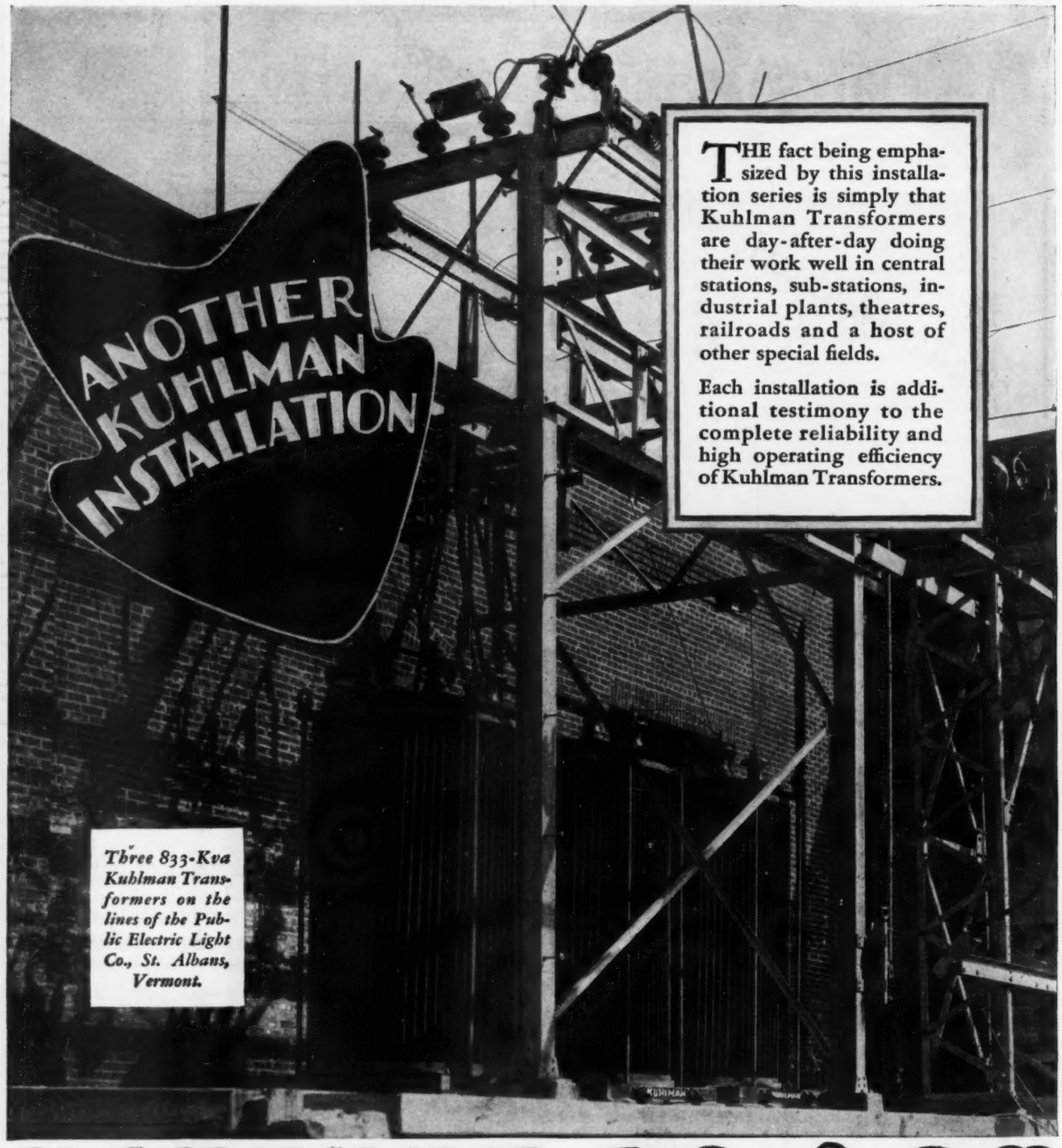
Line Material Department

OLIVER

IRON and STEEL CORPORATION

South Tenth and Muriel Sts., Pittsburgh, Pa.

"Oliver the Line"



THE fact being emphasized by this installation series is simply that Kuhlman Transformers are day-after-day doing their work well in central stations, sub-stations, industrial plants, theatres, railroads and a host of other special fields.

Each installation is additional testimony to the complete reliability and high operating efficiency of Kuhlman Transformers.

Three 833-Kva Kuhlman Transformers on the lines of the Public Electric Light Co., St. Albans, Vermont.

KUHLMAN TRANSFORMERS

KUHLMAN ELECTRIC CO., Bay City, Michigan

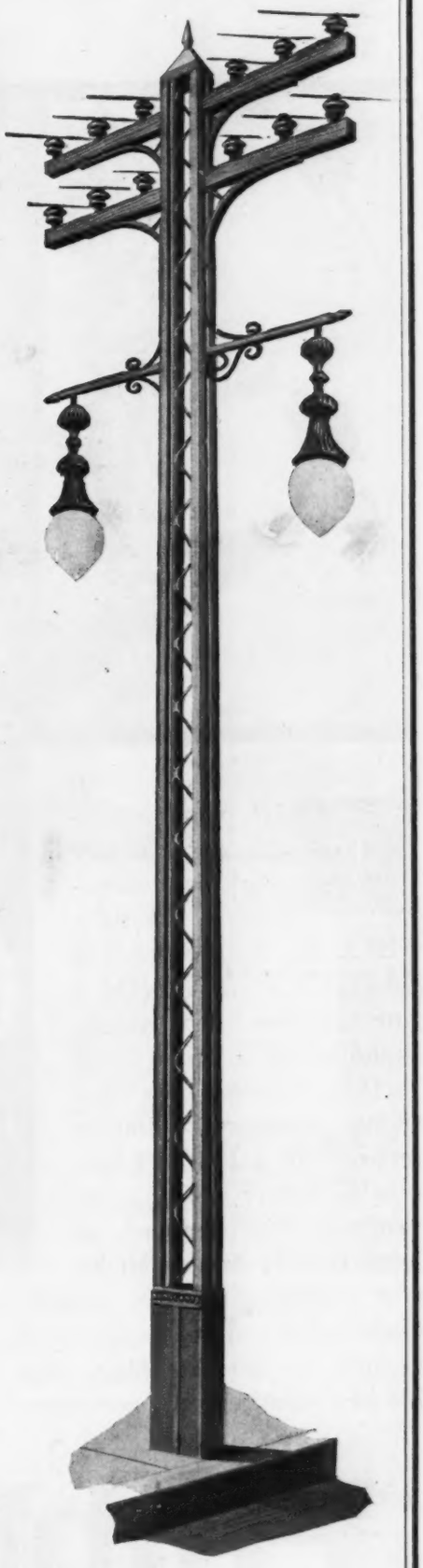
Akron	High and Barges Sts.	Dallas	1408 Allen Bldg.	Minneapolis	1004 Marquette Ave.	Salt Lake City	134 West 2d South St.
Atlanta	411 Glenn Bldg.	Denver	1535 Broadway	Montreal	415 Canada Cement Bldg.	San Francisco	Call Bldg.
Birmingham	307 S. 20th St.	Detroit	10-230 Gen. Motors Bldg.	New Orleans	1230 Hibernian Bank Bldg.	Seattle	514 Lloyd Bldg.
Boston	69-71 High St.	Greensboro, N. C.	333 S. Davie St.	New York	Graybar Bldg.	Tampa	Polk and Morgan Sts.
Buffalo	280 Carolina St.	Indianapolis	202 Indiana Ter. Whse.	Omaha	6315 N. 33rd St.	Toledo	424 Spitzer Bldg.
Chicago	844 Rush St.	Lincoln, Neb.	1425-35 M St.	Pittsburgh	839 Oliver Bldg.	Washington	1328 New York Ave. N. W.
Cincinnati	1308 Union Trust Bldg.	Los Angeles	316 American Bank Bldg.	Saint Paul	1479 Blair St.	York, Pa.	25 N. Duke St.
Cleveland	627 Union Trust Bldg.	Milwaukee	1031 Clybourn St.				

WELTRUS

(PATENT APPLIED FOR)

COPPER BEARING

POLES



An entirely new design, based on proved engineering practice, that is lighter, stronger and lower in cost than any other type now on the market. Permanent Weltrus Pole lines, embracing every known factor of durability, can be built at costs comparable with those for hazardous and temporary substitutes.

When equipped with ornamental pole caps and protection sleeves, Weltrus Poles have every quality necessary for satisfactory urban service.

Truscon engineers are available, without obligation to you, and will welcome the opportunity to demonstrate the point-for-point superiority of the Weltrus design.

COMPLETE INFORMATION

The Weltrus Steel Pole Catalog, which describes in detail the features and gives complete information on weights, strength and dimensions of standard types of Weltrus Poles, and contains details for attaching various fittings, should be in your file. We will gladly send you a copy.

Pole Line Hardware and Specialties

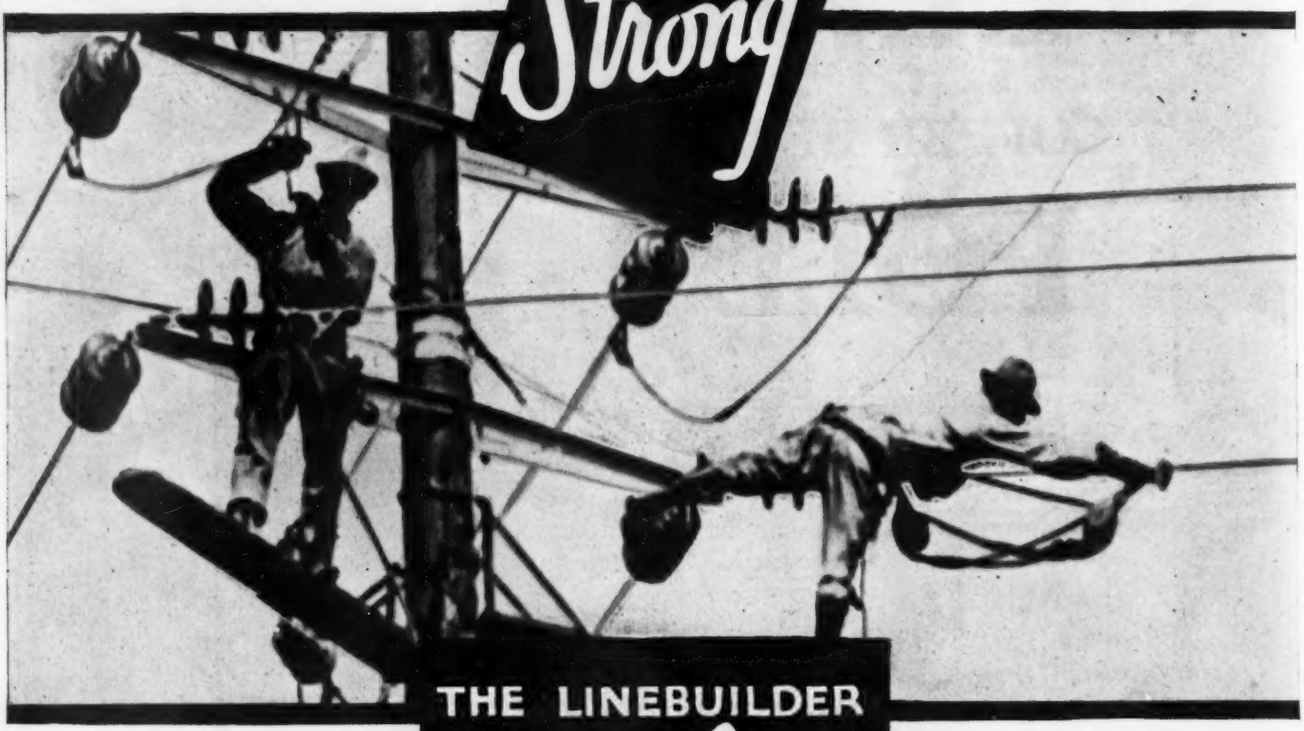
Truscon manufactures a complete line of hardware and specialties for every type of overhead or underground construction. Standard items stocked in twenty-five Truscon warehouses and by jobbers everywhere. Complete catalog on request.

STEEL POLES H-FRAMES
SUBSTATIONS

TRUSCON STEEL COMPANY
YOUNGSTOWN, OHIO

Manufacturers and Engineers

Factories at Youngstown, Cleveland, Detroit and Los Angeles



Strong

THE LINEBUILDER IS Safe ON A PEIRCE LINEMAN'S SAFETY PLATFORM

THE prime requisite for efficient work is concentration. With a PEIRCE LINEMAN'S SAFETY PLATFORM a lineman can concentrate. Standing on a broad level surface which does not swing sideways, doubly secured by a Peirce Lineman's Safety Strap, he proceeds with the task at hand exactly as though he was working on the ground. Only under conditions as secure as these is a lineman able to give his best efforts to his company.

For COMPLETE LISTING of this PEIRCE SPECIALTY Refer to the HUBBARD CATALOG

Six Supersafety Features

1. High grade tested steel chain.
2. Metal frame is forged to shape and properly tempered.
3. The steel spears for pole contact eliminate side swing.
4. A specially cured aeroplane spruce platform.
5. Platform is treated with a special insulating material.
6. Each platform is given a 600 lb. mechanical test.

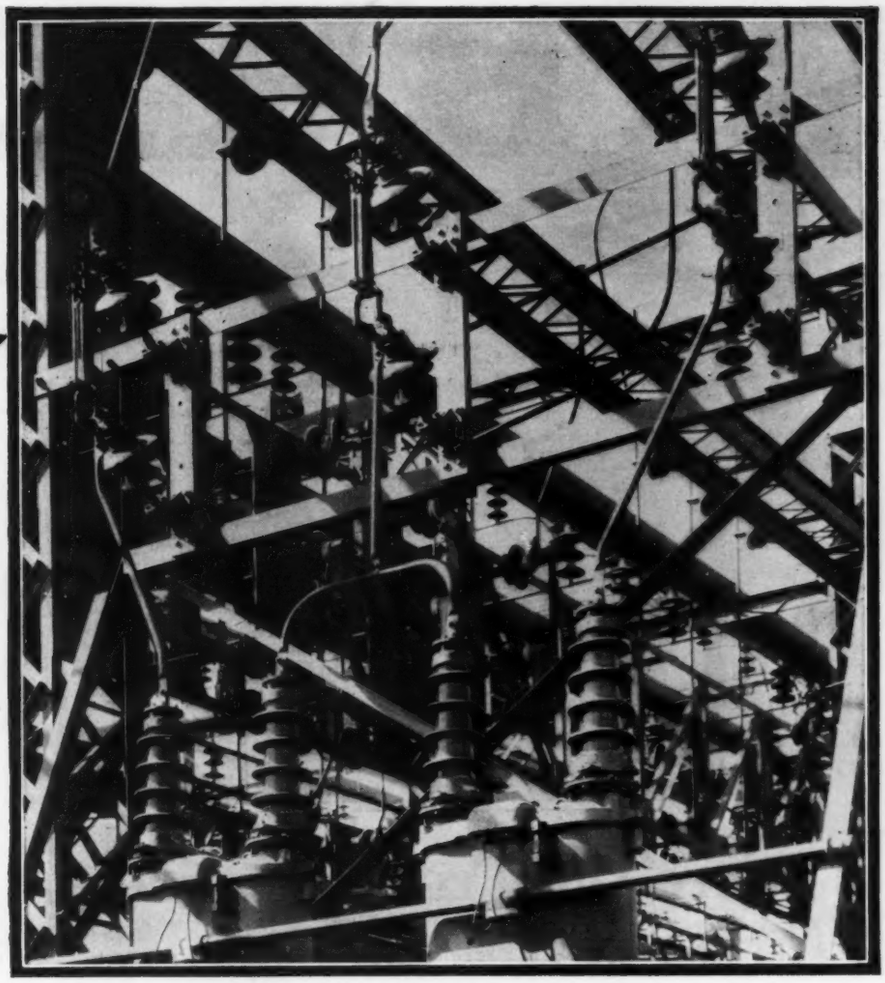
The many uses of this appliance, and its ready adaptability to almost any position make it a most valuable adjunct to construction and maintenance gang equipment.

HUBBARD

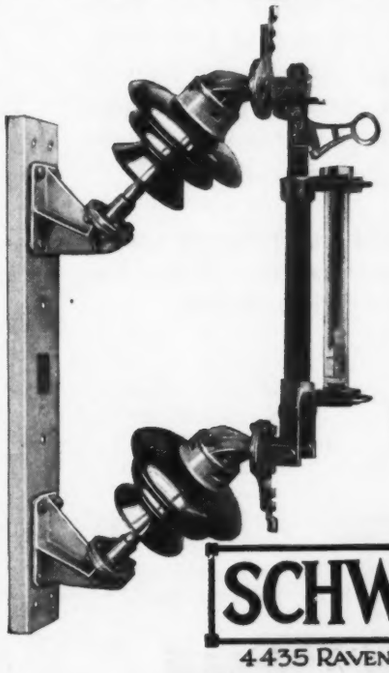
Hubbard and COMPANY

PITTSBURGH · OAKLAND, CAL. · CHICAGO

S&C Fuse and Disconnect in a Rugged well-made Combination for use



Where Space is Limited



The S&C Fuse you know and its reliability you know, but you may not be aware that there are available to go with it, mountings and combination equipment equally well made and reliable.

The Fused Disconnecting Switch in the installation pictured above is representative of S&C high quality switching equipment. There are 16 points in which it excels. Let us send complete information on this and other S&C Equipment, for either indoor or outdoor use.

Makers of the S&C *High Potential Fuse*

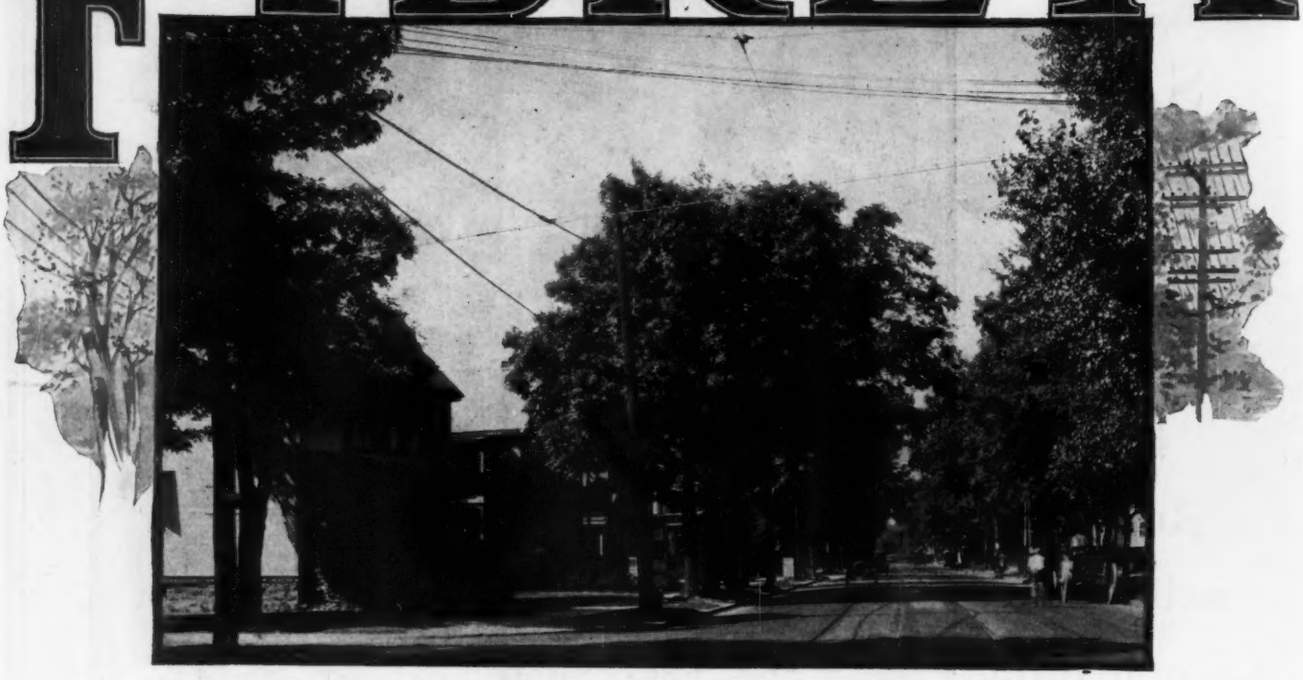
SCHWEITZER S&C CONRAD, INC.

4435 RAVENSWOOD AVENUE CHICAGO, ILLINOIS, U.S.A.

New York, Boston, Philadelphia — Buffalo, Pittsburgh, Birmingham — Detroit, Cleveland, New Orleans — Minneapolis, St. Louis, Kansas City — Denver, Omaha, Dallas — Seattle, Los Angeles, San Francisco

Japan, T. Hasegawa Co., Osaka

FIBREX



Spare the Trees—Splice in Fibrex

Civic beauty is now being considered more seriously than ever before. What to do and how to do it are questions foremost in mind. Where trees and their preservation are being considered, the solution is not difficult.

Except where pruning or trimming is necessary to preserve the symmetry of a row of trees—it is no longer necessary to use the axe and saw.

Right now the line department can quickly pick out the bad spots—places where grounds have occurred or are liable to occur—a short piece of FIBREX spliced in at these spots will eliminate grounds and voltage trouble.

Users know that FIBREX Tree Wire is non-inductive, will not rot and cannot rust, that moisture increases its wearing qualities, that it prevents arcing, short circuits and leakage and is strong both mechanically and electrically.

FIBREX installations, properly made, are practically permanent. Write for sample and further information.

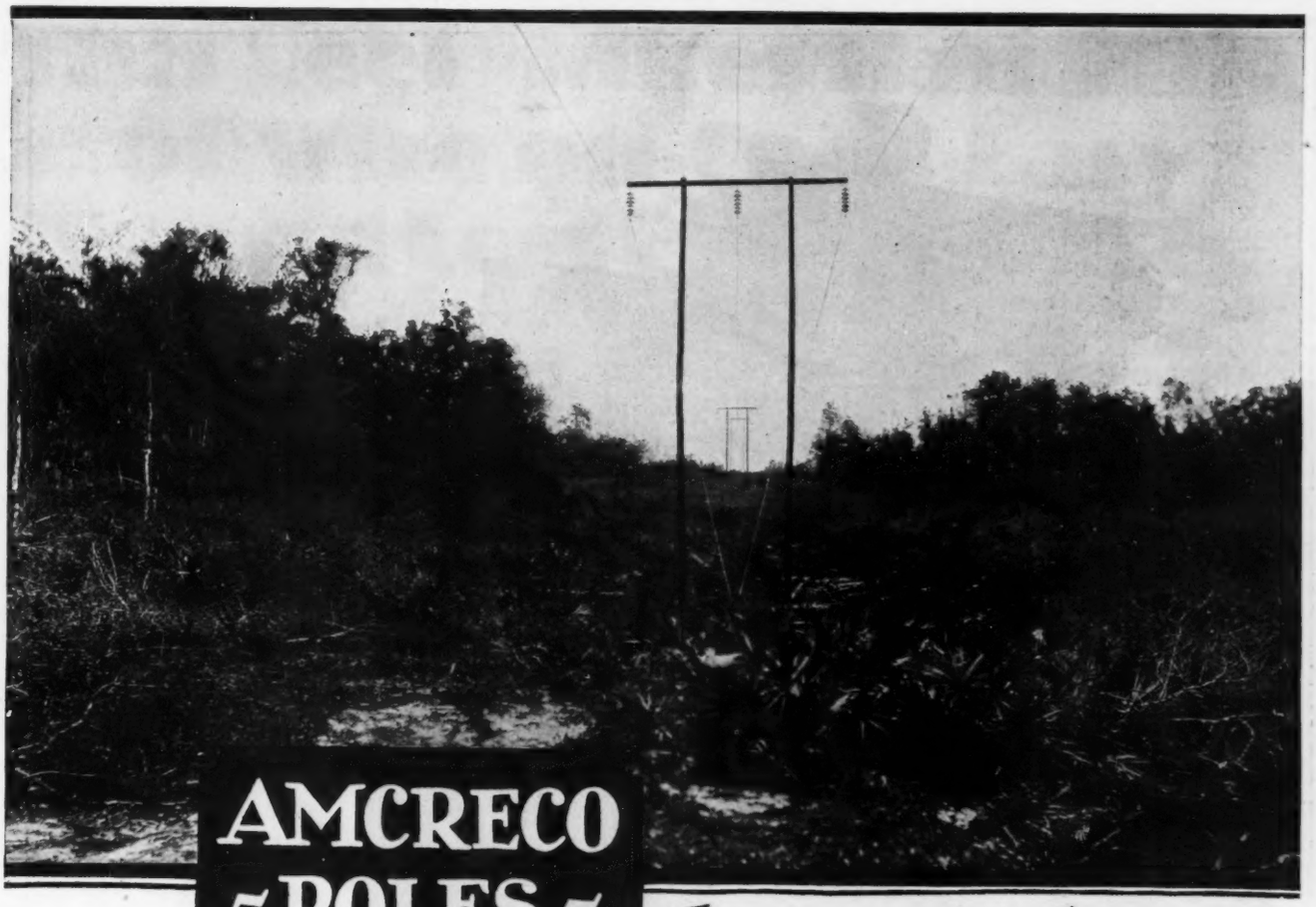
SIMPLEX WIRE & CABLE Co

MANUFACTURERS

201 DEVONSHIRE ST., BOSTON

BRANCH SALES OFFICES

CHICAGO, 564 W. Monroe St. SAN FRANCISCO, 390 Fourth St.
NEW YORK, 1328 B'way CLEVELAND, 2019 Union Trust Bldg.
JACKSONVILLE, 1010 Barnett Nat'l Bank Bldg.



AMCRECO -POLES- *do not decay*

UNTREATED poles decay—in some cases very rapidly.

But Amcreco poles resist this attack of nature. They are preserved by full pressure treatment by the Lowry process using pure creosote oil. Years of experience have demonstrated the preservative and practical value of creosote oil in wood preservation. Similarly, the superiority of the Lowry process has been firmly established.

You can safely estimate the life of Amcreco poles at 35 years or more.

Let our nearest office quote on your requirements.

AMERICAN CREOSOTING COMPANY

INCORPORATED

COLONIAL CREOSOTING COMPANY INCORPORATED

AMCRECO LOWRY PROCESS CREOSOTED WOOD

GEORGIA CREOSOTING COMPANY INCORPORATED

LOUISVILLE — KENTUCKY

EW6-28Gray

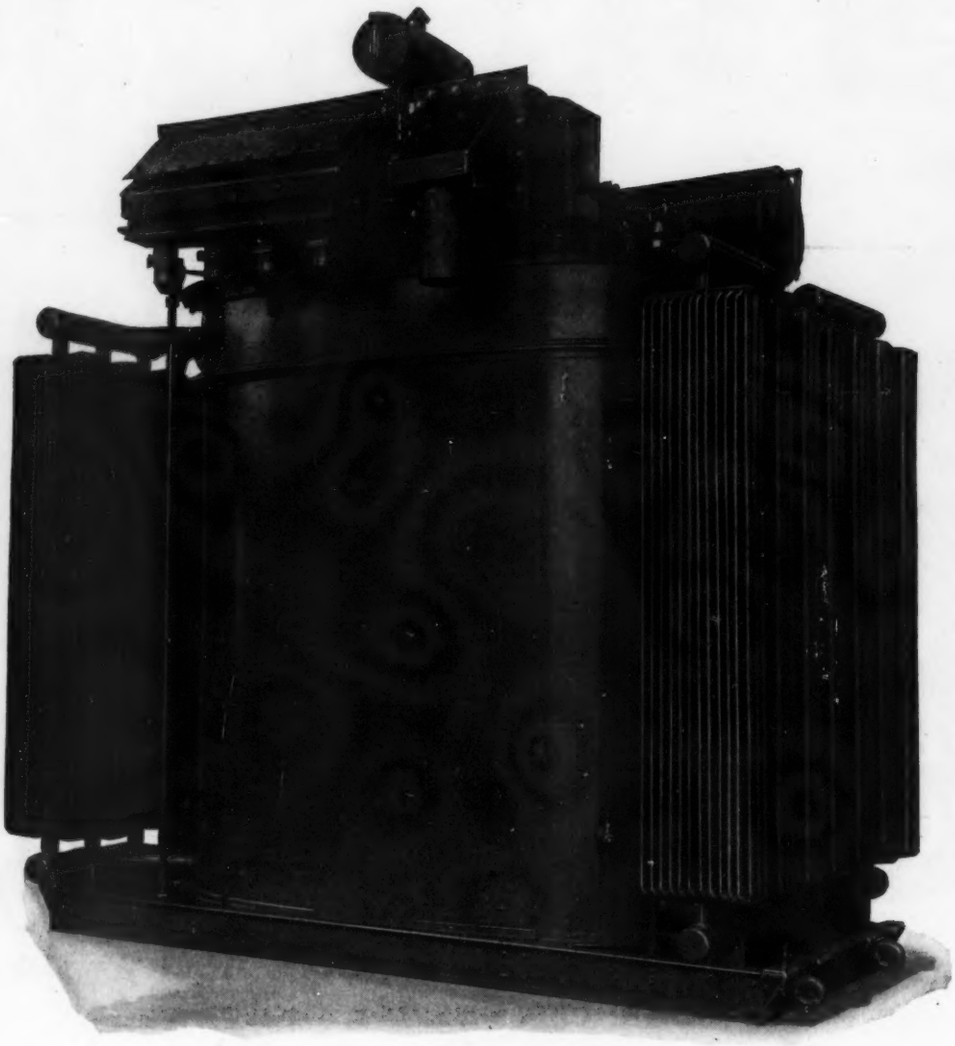
SALES OFFICES

332 So. Michigan Ave., Chicago

350 Madison Ave., New York City

401 W. Main St., Louisville Ky.

Brunswick, Ga.
Bogalusa, La.



This Pittsburgh Polyphase Transformer is rated at 5250 kv.a., 13,800 delta volts high side and 2400 delta /4150 star volts low side. It is arranged for cable connections for both high and low voltage sides by means of potheads. The potheads are oil filled and may be disconnected from the transformer as a unit. This permits the transformer to be disconnected from the cable system without disturbing the wiped cable joints.

Pittsburgh Transformers

Pittsburgh Power Transformers, both single phase and polyphase have a double magnetic circuit core. This results in noiseless and more efficient operation. The tanks and the radiators are built of copper alloy (rust resisting) steel. The rectangular base construction facilitates moving and handling. Pittsburgh Transformers with film type radiators save in floor space. Fewer radiators are required because of their very efficient heat dissipation.

ALLIS-CHALMERS MANUFACTURING CO.

PITTSBURGH TRANSFORMER WORKS

North Side, Pittsburgh, Pennsylvania

This Reel Makes Handling of Wire on Coils Easy and Less Expensive

MATTHEWS ADJUSTABLE REEL makes the handling of wire on coils very easy... much more so than wire on wooden reels. Adjustable to fit any size coil. It is used for take-up or pay-out. Since the wire can be purchased in coils, the cost of the wooden reels and their freight charges are thereby saved.

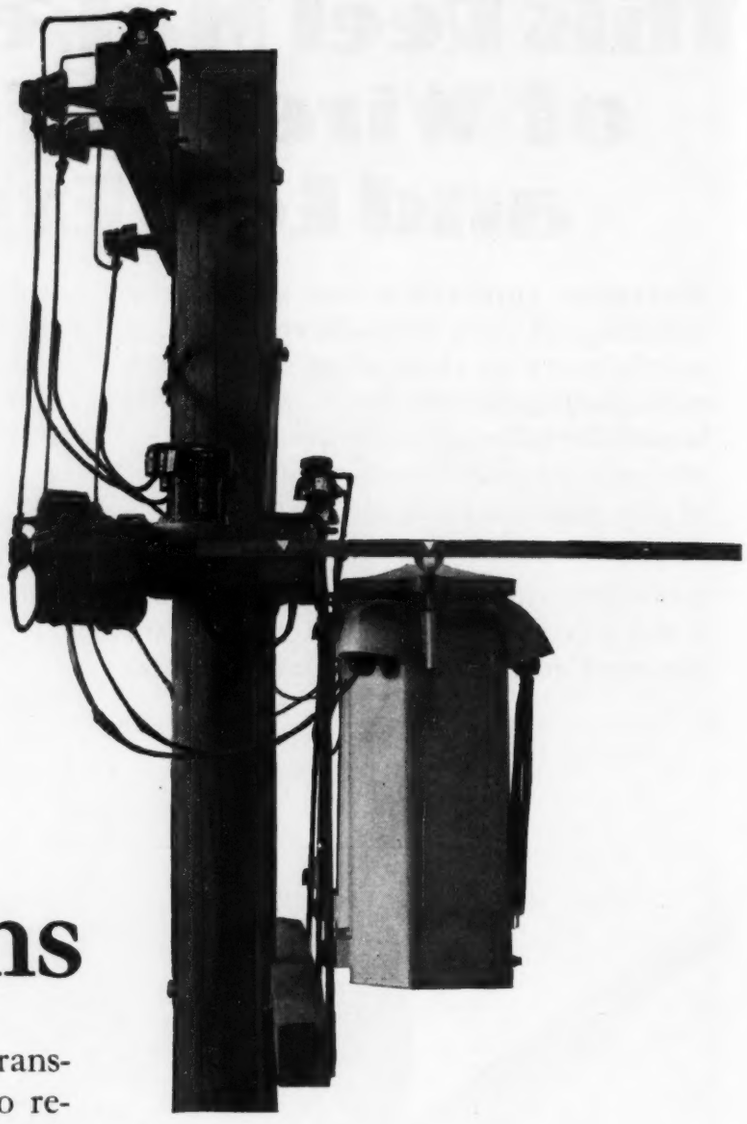
It is adjustable. When stringing wire it is not necessary to pull wire down on the road and then coil by hand, as the pulling out and coiling can be done at the same time on the Matthews Adjustable Reel. The reel table is metal and can be grounded, affording safety to the operator.

For complete information send for Bulletin 900. Your nearest electrical distributer can supply you with Matthews Specialties.

W. N. MATTHEWS CORPORATION
Engineers and Manufacturers
3702 Forest Park Blvd. St. Louis, U.S.A.
Offices in All Principal Cities

MATTHEWS
ADJUSTABLE REEL
For Both Pay-Out and Take-Up
(Furnished With or Without Brake)

153



Minimum Strain on Cross Arms

Packard Distribution Transformers are so designed as to relieve the cross arms of as much strain as possible. Hanging as close as they do to the pole also makes it easier for the lineman to work around them.

Light in weight, with all-welded alloy steel tanks, they are convenient to stock as well as being easy to handle.

Other features of construction and design are just as modern. Operating characteristics are second to none.

Further information is to be found in our new Bulletin 200-B. If you desire a copy, the coupon is for your convenience.

The Packard Electric Company, Transformer Division, Warren, Ohio.

Gentlemen:

Please send me a copy of your bulletin 200-B covering distribution transformers.

Name .....

Company .....

Address .....

The Packard Electric Company Warren Ohio

Packard is never seen except on goods of honest value

Established 1890

Double Decking

MEANS GREATER CURRENT DENSITY

"Three E" Bus Bar Supports

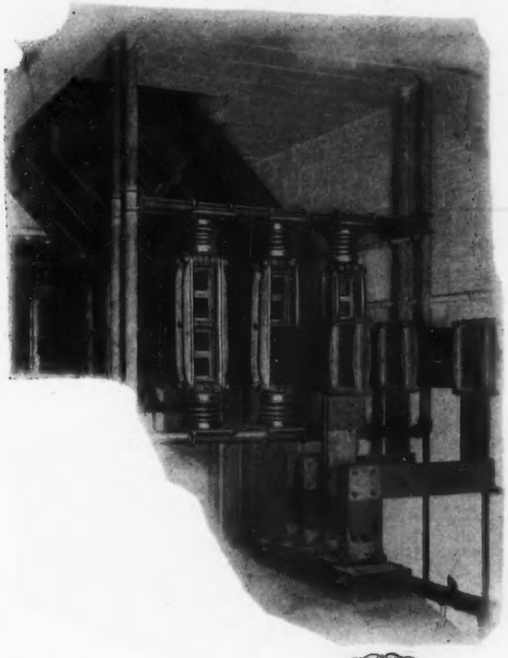
That "Three E" Bus Bar Supports are double decked is just another example of the extent to which this organization goes to obtain greatest electrical and mechanical efficiency in high tension equipment.

This type of support is a distinct "Three E" development. The conducting bars are carried on supports, arranged one above the other. It is particularly a most economical type where large amounts of alternating current are handled. In high amperages it requires twice the amount of copper to carry the same current where old style Bus Bar Support Construction is employed.

We specially recommend that you submit your problems to us where the handling of large amounts of current is a consideration.

"Three E" Service Value* is worth investigating.

Ask for Bulletins.



* "Service Value" = Low cost per year of service

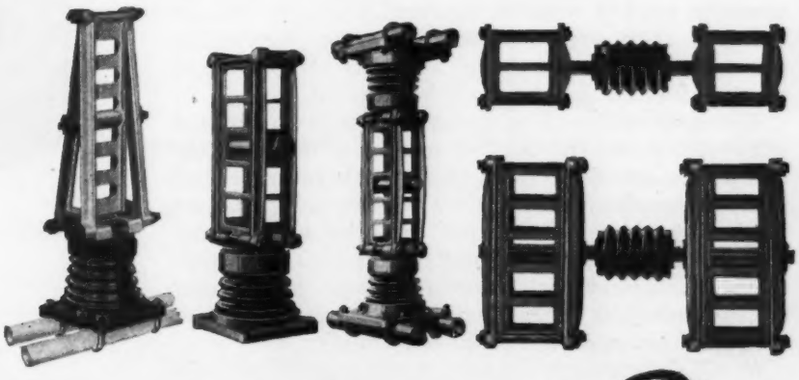
ELECTRICAL ENGINEERS EQUIPMENT CO.

General Offices and Factory: MELROSE PARK, ILL.

Chicago Office: 803 W. Madison St.
Eastern Office: 21 Park Row, New York

Sales Offices in all principal cities

Canadian Representative: Northern Electric Company LIMITED

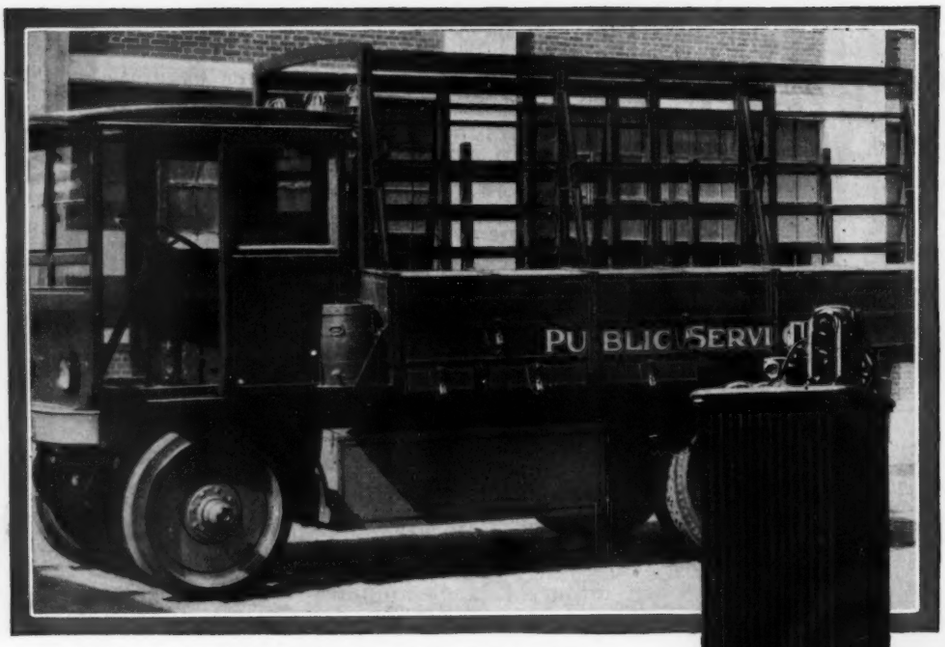


THREE E — ELECTRICAL ENGINEERS EQUIPMENT CO. — MELROSE PARK, ILL. U.S.A. — THE MARK OF QUALITY

It pays to use The 'Three E'

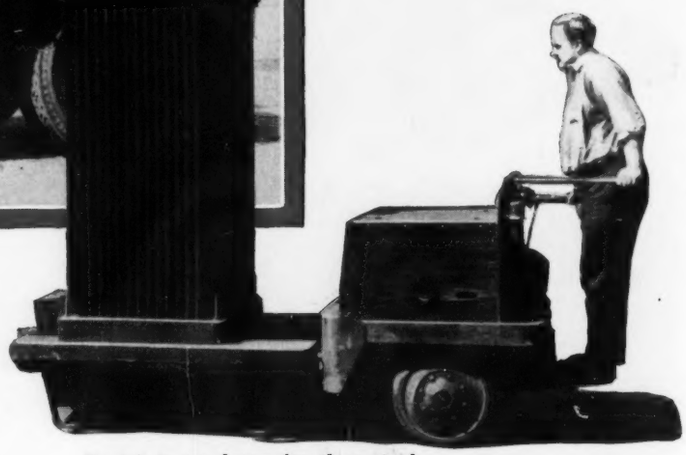
WRITE FOR *Catalogue*

Economy on Short Hauls? electric trucks insure it



On all kinds of short-haul service transportation—from delivering a few bulbs to hauling heavy reels of cable—electric street trucks are saving money for public service companies.

That's why central stations everywhere are now adopting this modern means of transportation



No job is too heavy for these sturdy electric industrial trucks. Their adaptability and ease of handling make them especially convenient for use around the plant.

IN the plant and on the street . . . for every type of short-run transportation job . . . electrics are saving money for public service companies.

This saving is apparent as soon as electrics go on the job. It continues throughout their entire long period of service . . . and the normal life of an electric truck is from ten to fifteen years.

No work is too heavy for these sturdy vehicles. They can be equipped for raising poles. Fitted with powerful electric winches operated from the storage battery, they are unusually efficient for cable-pulling. There is practically no end to the variety of special uses to which they may be adapted.

Economy on short hauls, combined with exceptional adaptability, are the two big reasons so many utility companies are electrifying their truck routes. And these companies find that they get especially efficient service when their trucks are equipped with Exide-Ironclad Batteries. The high voltage of these batteries throughout their discharge, their great power ability, and their rugged construction, all combine to keep maintenance costs at the very minimum.

We will gladly give you the name of public service companies that have had long experience with electrics. Then you can get first-hand information for yourself . . . learn how you, too, can reduce the costs on your short-haul transportation.

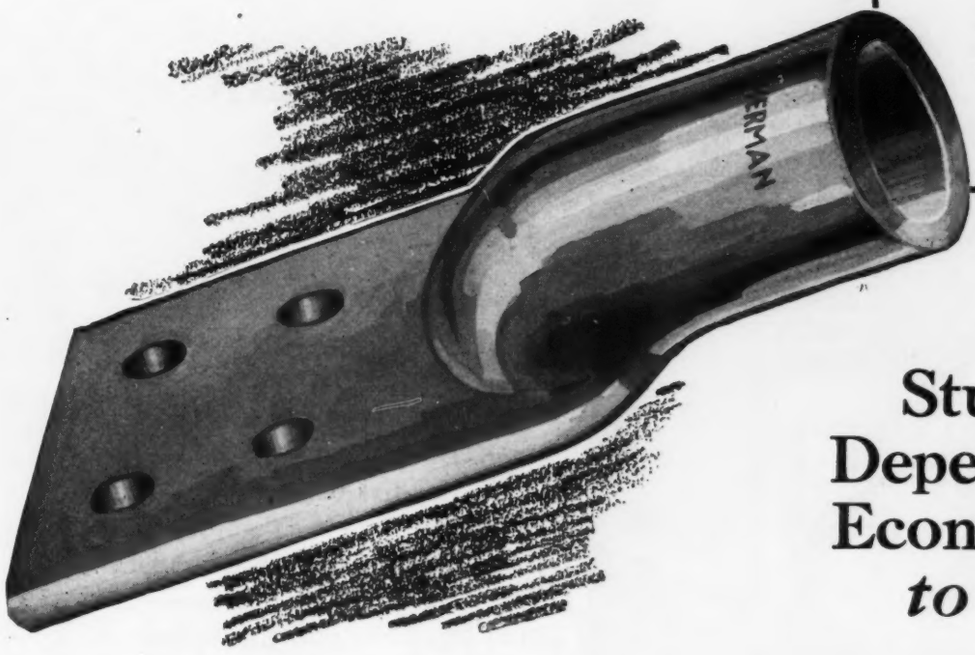
Typical Exide-Ironclad Battery for use in electric street trucks—powerful, rugged and dependable throughout its many years of active service.

Exide
IRONCLAD
BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia

Exide Batteries of Canada, Limited, Toronto

SHERMAN Heavy Duty Soldering Lugs



Flat Contact Surfaces

Sturdy Dependable Economical *to use*

Made to N.E.L.A. Specifications

The dimensions are carefully maintained. The general finish shows the great care used in their manufacture. Specialized methods, together with latest type of machinery and tools insures the highest standard of quality. Each lug is plainly marked on the barrel with the word "SHERMAN" and the number.

Obtainable in sizes to accommodate wire from No. 19/22 to 2,000,000 C. M.

Furnished blank or with regular stud holes.

SOLD BY JOBBERS

Headquarters for terminals

Sherman makes a high quality, complete, and economical line of terminals for the ends of cables and wires. They are now generally accepted as the proper terminals to use because of their exclusive features, advantages, and economy. Ask for descriptive literature.

Seamless extra heavy copper tubing used

Sherman Heavy Duty Soldering Lugs were designed by specialists who had a complete understanding of the need for reliable, durable lugs. Light and power companies and leading manufacturers are now standardizing on these lugs because of completely satisfactory results with economy.

Sherman makes a complete standardized line of adequate size and strength to meet every mechanical and electrical need. These lugs are the highest standard of workmanship and quality— they are free from burrs and other faults. Because of their great serviceability these lugs are less expensive than special lugs. The cost of a Sherman Heavy Duty Soldering Lug is negligible in contrast to the cost of the cable it protects.

Look for SHERMAN HEAVY DUTY Soldering Lugs on Electrical Apparatus.

H. B. SHERMAN MFG. CO.
Battle Creek, Mich.

ORANGEBURG FIBRE CONDUIT

Time tells the Story

of its superior performance

NO other underground cableway has behind it a record of service that even approaches that of Orangeburg Fibre Conduit. For 35 years and more it has been used by public utility companies, municipalities and general industries in all parts of the world. Thousands of miles of underground electric cables are guarded against deterioration by its use.

The safe and permanent protection it affords is thoroughly vouched for by many important installations that today, after more than a generation underground, are still in perfect condition.

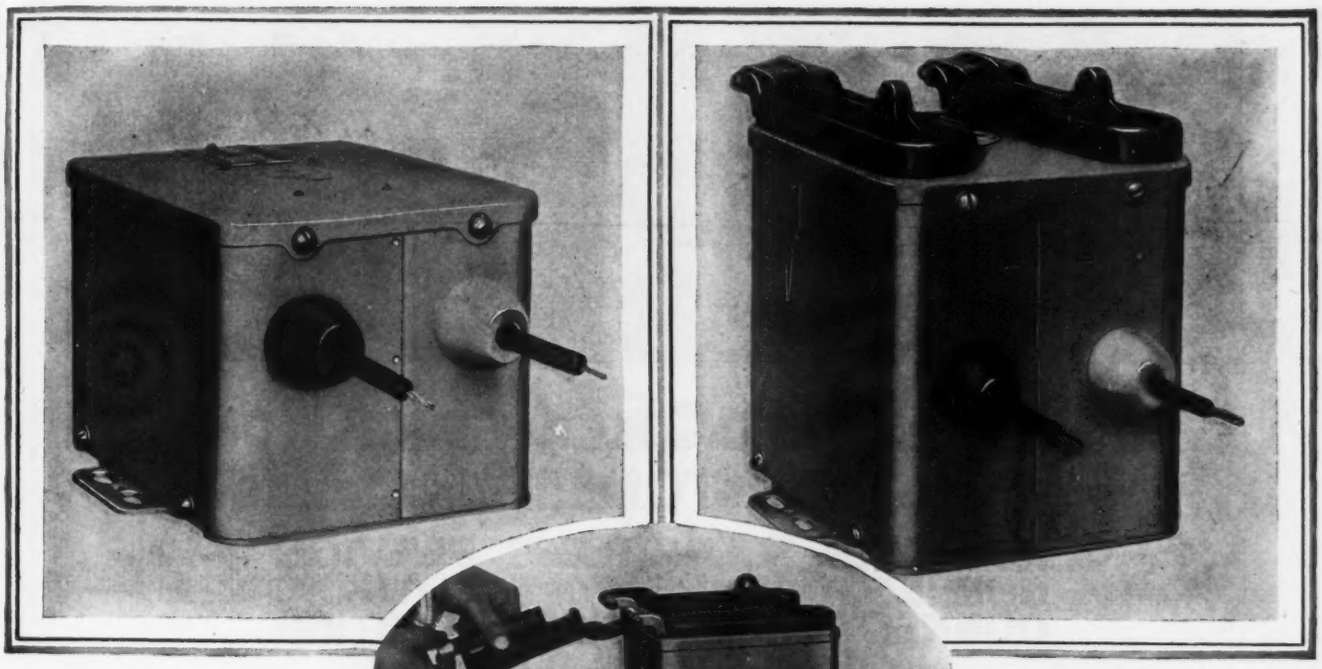
Orangeburg Fibre Conduit is made in convenient five foot lengths that are easy to handle and install. Made with smooth fitting joints it provides a cableway uniformly smooth and circular. Cables are never damaged while being drawn through Orangeburg Conduit.

We'll be glad to give you complete information of this most practicable of cableways. Address: Johns-Manville Corporation, 292 Madison Avenue, New York City, for detailed information.

THE FIBRE CONDUIT CO. REG. U.S. ORANGEBURG PAT. OFF. ORANGEBURG, N.Y.

The Fibre Conduit Co.
ORANGEBURG, NEW YORK

Johns-Manville
CORPORATION
SOLE SELLING AGENTS



Type E-31

Type E-32

Higher Insulation a Feature

of New Instrument Potential Transformers

These indoor potential transformers supersede 200 volt-amp., 60-cycle Types E-21 and E-22 in voltage ratings of 220 to 2500.

Their insulation, both in the windings and terminals, is materially higher than that maintained in the older types. They are suitable for use on either delta- or Y-connected circuits. Their liberal design assures successful operation, even should a 2500-volt Y-connected unit be operated on 4400 volts for 24 hours.

These transformers are rated 100 volt-amperes on an accuracy basis. They have the same ratio and phase-angle characteristics as the 50- and 200-volt-ampere transformers. On a heating basis, the rating is 300 volt-amperes.

A marked improvement has been made in the fuse blocks (Type E-32). The block has a hinged cover which carries the cartridge fuse on the inside. No fuse pullers or auxiliary tools of any kind are required.

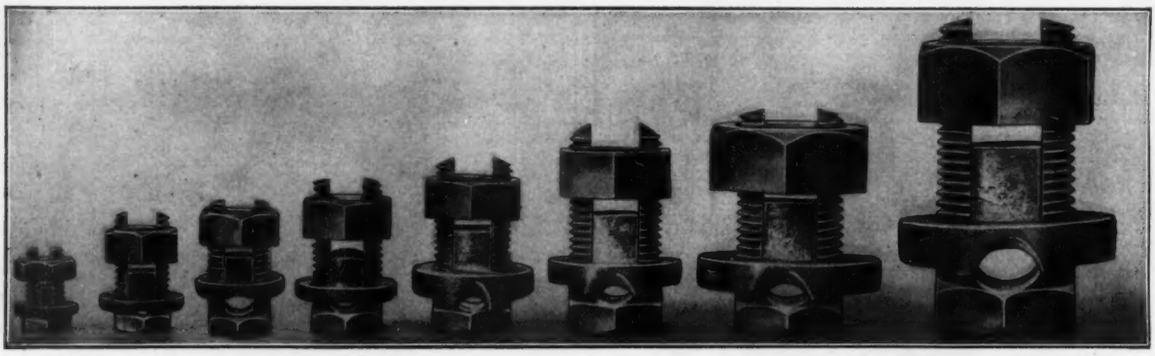
Mounting dimensions are the same as those of the superseded transformers.

More detailed information is given in bulletin GEA-1019, obtainable from your G-E sales office.

610-28

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

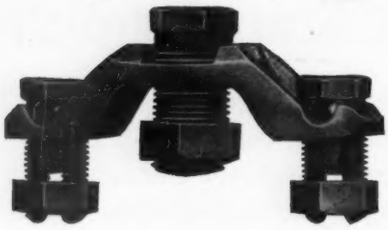


NO SOLDERING—NO COLLAPSE OF BOLTS

Note the ADDED TONGUE *on the washer*

KEARNEY SOLDERLESS SERVICE CONNECTORS PERMIT QUICK CONNECTING AND DISCONNECTING —OF SERVICE TAPS—

HUNDREDS of Utility Companies are now making their service taps with Kearney Solderless Service Connectors. Eight different size single connectors are available. The larger connector is for No. 4-0 stranded or smaller, and the smaller size connector will take No. 10 wire, solid or smaller. The added tongue on the washer prevents the walls of the bolt from collapsing and prohibits the nut from slackening off. The main and tap are clamped together in actual contact with each other. These connectors are made of non-corrosive high conductivity materials. Use Kearney Connector on residence service connections off of the main secondary, permitting service to be discontinued or restored when necessary. These connectors make possible the use of hard drawn copper, eliminate the necessity of using hot solder and blow torch, do not require new splicing of the wires, as the same tap wire can be used over and over again, can be used where range loads make twisting heavy tap wires difficult, and they permit testing on the ground wire with ease.



KEARNEY Double Solderless Service Connectors have a particular application for use where two services extend from each main, independent of the other. The surface of each split bolt is supported with a tongue on the casting, which extends through the nut, thus supporting the wall of the slotted bolt.

Other KEARNEY Products

Certified Malleable Iron Screw Type Anchors, Hi-Tension Four-In-One Expansion Anchors, "Double Duty" Fuse and Disconnect Cutouts, Convertible Fuse Switches, Disconnecting Switches, Choke Coil and Choke-Fuse Combinations, "Handy" Fuse Pullers, Expulsion Plug Cutouts, Guy Wire Clips, Sleeve Twisters with Interchangeable Dies, "Hot" Tap Clamps, "No-Serve" Yokes, "Economy" Cable Clamps, Accessible Cable Joints for Underground Work.

ELIMINATE RADIO INTERFERENCE

INSTEAD of just twisting tap wires, which in many cases is the cause of radio trouble, use Kearney Solderless Service Connectors. A depression in the center of the washer permits the wires to fit snugly together, assuring perfect contact. Constant vibration does not loosen these connectors, as this has been proven through a series of actual tests.

Connector Information Complete in Bulletin 310

JAMES R. KEARNEY CORPORATION

4224 Clayton Avenue • • • • • ST. LOUIS, MO.

Note the added tongue on the washer of the above Kearney Single Solderless Service Connector.

KEARNEY

OVERHEAD AND UNDERGROUND UTILITY EQUIPMENT

Gould now presents
a new complete line of
Station Control and Emergency Current Supply Cells

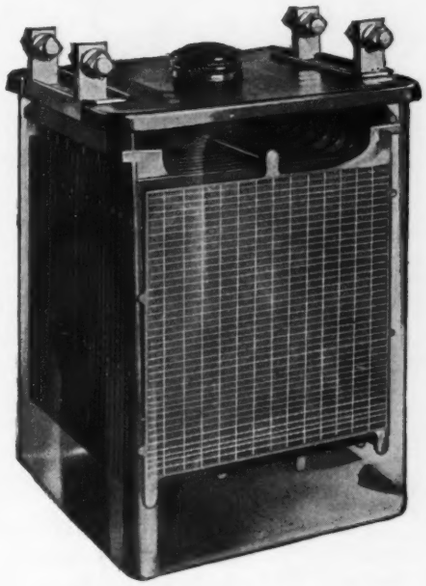
Advanced designs in new standard paste plate and Gould Kathanode cells for high-rate discharge service.

GOULD now offers a new complete line of sealed glass jar cells for high-rate discharge service. Capacities range from 44 ampere hours at the 8-hour rate up to 1,000 ampere hours. High discharge capacities of from 75 to 1500 amperes are available at one minute rate down to 1.75 volt.

8 advantages

Of special interest to all users of this type of equipment are these features of the new Gould line:

1. Improved details of mechanical construction that embody many new features of battery design.
2. Great mechanical ruggedness and long life under trickle charge.
3. High voltage characteristics at heavy discharge rates.
4. High capacity and electrical efficiency.
5. Maximum ease of installation.
6. Ample liquid space.
7. Suspended type unit elements.
8. Most reasonable in price.



Type OSB Gould Kathanode Cell

One of the most important features of this new line is the new Gould Kathanode construction. This recent advance in battery practice is particularly suitable for central station applications, due to its long life under trickle charge operation. In the Kathanode assembly a spun glass retainer mat (patented) is placed against both surfaces of the positive plate. It permits free access of electrolyte to the plate surface but securely holds the active material in the plates. Sedimentation is practially eliminated, thereby removing the chief disadvantage of the high capacity paste plate cell under trickle charge operation. In submarine cells, and under severe conditions of railway car-lighting service as well as in central station applications, Gould Kathanode construction has demonstrated its ruggedness and long life.

Details on request

Backed by over a quarter century of experience in building batteries for every use, this new Gould line is presented with full confidence that it meets every requirement in its field. Full information, specifications and blue prints will be furnished on request. And Gould engineers will be glad at any time to advise with you on problems involved in the use of this type of equipment. Gould Storage Battery Co., Inc. Depew, N. Y.

GOULD

New York: 250 Park Avenue
Chicago: 32 West Randolph
Huntington, W. Va.: First National Bank Bldg.
San Francisco, Cal.: Hobart Building

OVER A QUARTER CENTURY OF EXPERIENCE IN BUILDING BATTERIES

Outdoor Substations

Flexible and Easy to Construct

OUTDOOR pipe substations, constructed with Westinghouse fittings for pipe structures, give unparalleled flexibility and ease of construction.

Flexibility is attained through a structure that can be very easily changed to meet varying conditions; such as, increasing its size and rearranging to allow for additional apparatus.

They are easy to construct because the work can be done by unskilled labor.

Both of these important features are made possible because the pipe does not have to be cut to accurate measurements, nor does it have to be threaded. A single wrench and a hack saw will do the work.

Ask our nearest district office for a copy of circular 1676-A entitled, "Fittings for Pipe Structures"

Westinghouse Electric & Manufacturing Company
East Pittsburgh Pennsylvania

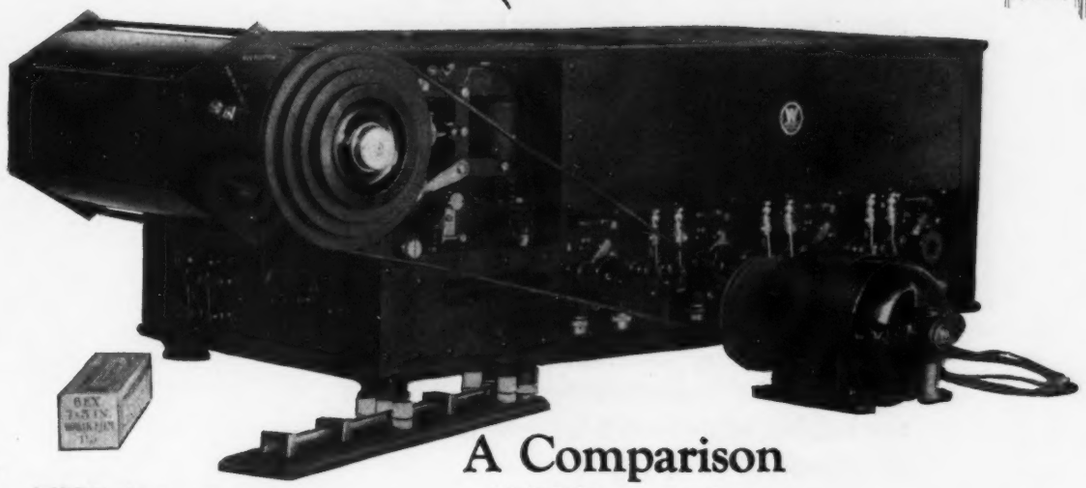
Sales Offices in All Principal Cities of the United States and Foreign Countries

W WESTINGHOUSE ELECTRIC

Westinghouse

X98711

The PROGRESS of OSCILLOGRAPHY



A Comparison

In the Early Days—	*Today—*
Two or more tables full of apparatus.	All apparatus can be placed in a suit case.
Several operators and assistants required.	Only one operator required.
Sensitive adjustments necessitating a laboratory set up.	Sturdy equipment not easily damaged.
Arc lamp and large rheostats.	Incandescent lamp with self-contained adjustments.
Dark room loading film holders.	Daylight loading film holders—standard films.
Every test a staged test.	Automatic operation with simple connections.
Several days to set up a test, even with skilled operators.	Can be set up for action within two hours.

The instrument specialist in the Westinghouse district office near you will be glad to arrange a demonstration at your convenience.

Westinghouse oscillograph apparatus includes a complete line of equipment. See Westinghouse Catalogue of Electrical Supplies.

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We offer ' '

1 ***A name,*** **nationally advertised and nationally known, adding its prestige to that of the manufacturer.**

' '

2 ***A selling organization*** **that penetrates to the smallest and most distant market—a sales force through which immediate national representation may be secured without adding a man to the manufacturer's payroll.**

' '

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' '

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' '

5 ***A credit and collection mechanism*** **to handle the thousands of scattered and diverse accounts relieving the manufacturer of expense, worry and the possibility of credit loss.**

' '

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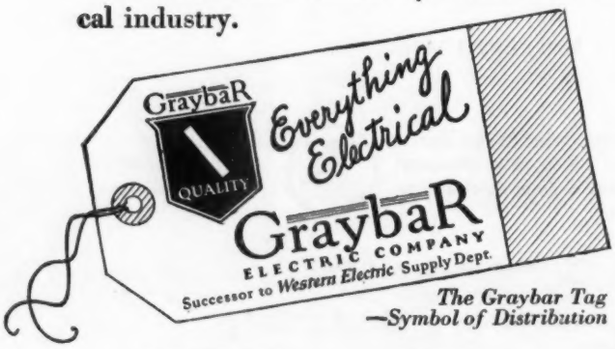

The Graybar Tag
—Symbol of Distribution

ALBANY	BOSTON	CINCINNATI	DAYTON	FT. WORTH	JACKSONVILLE
ASHEVILLE	BROOKLYN	CLEVELAND	DENVER	GRAND RAPIDS	KANSAS CITY
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BIRMINGHAM	CHICAGO	DAVENPORT	FLINT	HOUSTON	MEMPHIS
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TO THE ELECTRICAL *BUYERS* OF AMERICA

We offer ' ' '

1 *A reputation* acquired through fifty-nine years of service, adding its guarantee to that of the manufacturer.

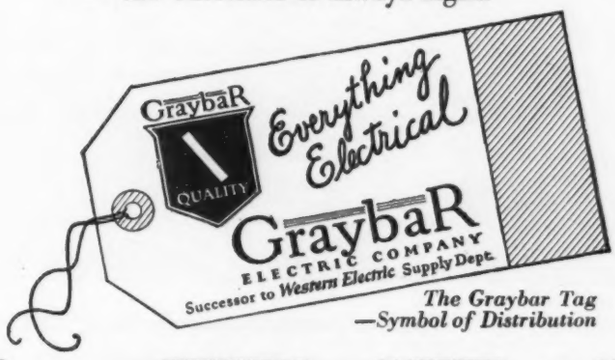
2 *A knowledge* of the buyer's needs acquired through long and intimate contact with all phases of the industry.

3 *A concentration* of all types of electrical material, so complete as to eliminate the annoyance and uncertainty of purchasing from many scattered sources.

4 *A service of supply* for quickly meeting all needs, when, where and as they arise, by prompt delivery from a nearby distributing house instead of delayed shipment from a distant point of manufacture.

5 *A research service* for seeking out new and improved electrical equipment, thus helping the customer to keep in touch with the latest developments in the industry.

6 *A policy* based on the premise that the customer is always right.



The Graybar Tag
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MILWAUKEE	NEWARK	PITTSBURGH	ROCHESTER	SAN FRANCISCO	TACOMA
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NASHVILLE	OAKLAND	PROVIDENCE	ST. PAUL	SEATTLE	TOLEDO
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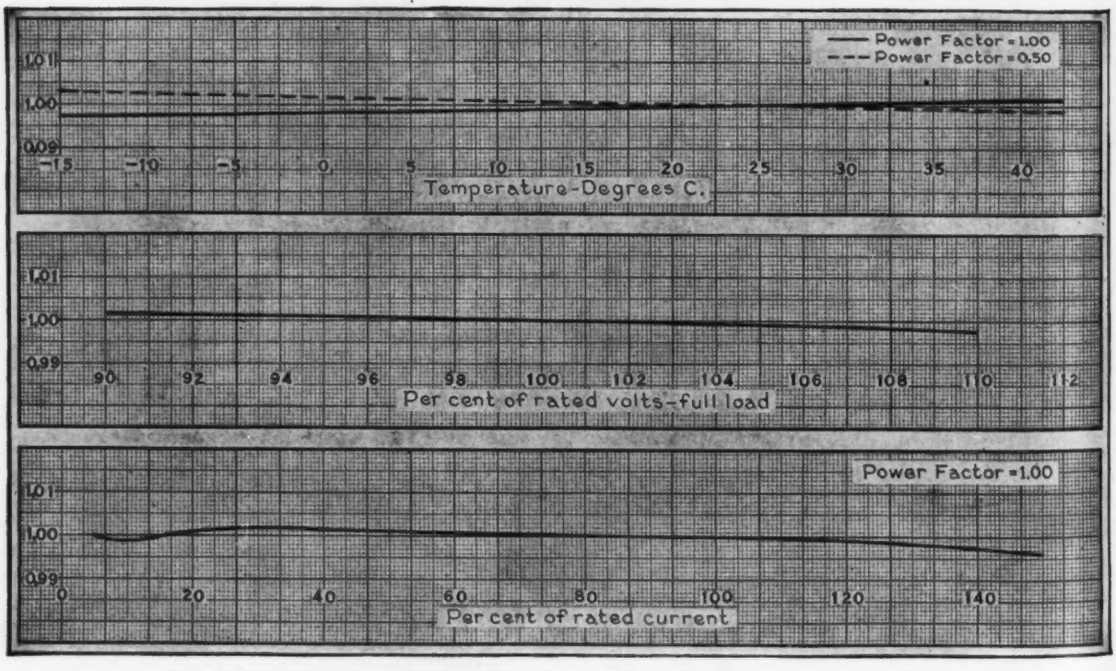
Superior Rotating S

These meters possess exceptional performance characteristics and improved mechanical features.

The effects of variation in voltage, frequency, and power-factor are reduced to negligible values. There is almost entire freedom from temperature errors. As in the case of the other G-E watthour meters, high torque is an outstanding characteristic. These facts unquestionably establish the superiority of these meters for precision work.

These are some of the new mechanical features: A metal case which is attractive in appearance and durable. A moulded bakelite top, with a gasket which renders the meter moisture-proof and dust-proof. An improved zero set-back device, furnished with both meters. The commutating switch in the type IB-8 meter for changing current capacity is also of improved design.



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GENERAL

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

Standards

Type IB-7 Portable Test Meter
110-200 volts 1/5/20 amp.

A small, light-weight standard, considerably smaller than the type IB-8, with ratings limited to three values. It is intended for testing service meters of moderate ratings or those used with instrument transformers.

Type IB-8 Portable Test Meter
110-220 volts, 1/5/10/50/100 amp.

This meter embraces a wide range of ratings and is suitable, therefore, for testing service meters of practically any size. The commutating switch facilitates changing the connections to get the desired rating.

600-18

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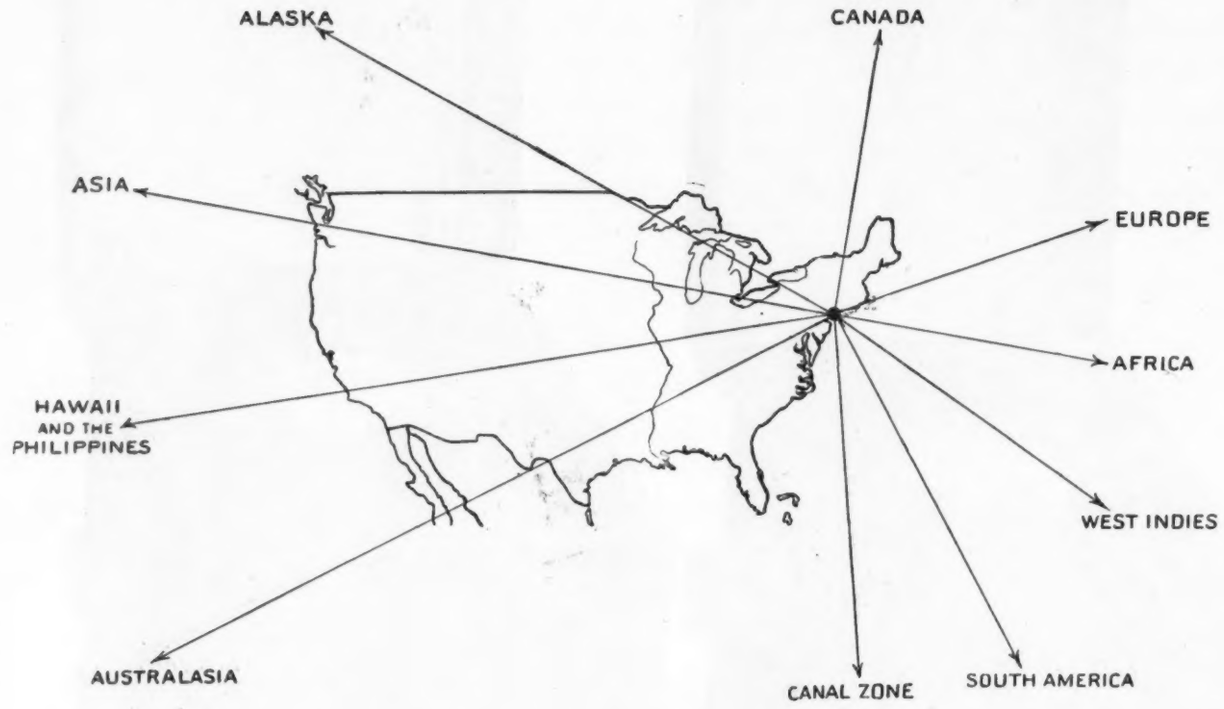
An INTERNATIONAL Service



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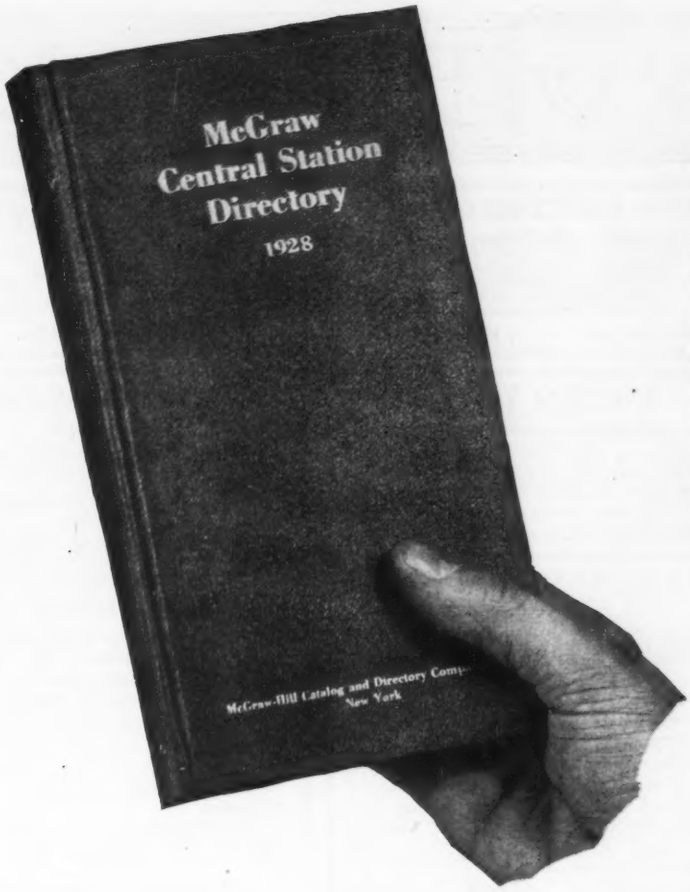

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IF YOU are qualified for position between $2,500 and $25,000, and are receptive to negotiations for new connection, your response to this announcement is invited. The undersigned provides a thoroughly organized service, established seventeen years ago, to conduct confidential preliminaries, and assist the qualified man in locating the particular position he desires. Not an employment agency. Retaining fee protected by refund provision, as stipulated in our agreement. Send name and address only for description of service. R. W. Bixby, Inc., 262 Main Street, Buffalo, N. Y.

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ELECTRICAL engineer, 12 years' experience as superintendent of construction, electrical and mechanical; power plants, substations, transmission lines and distribution systems; capable of assuming full charge. PW-598, Electrical World, 7 South Dearborn St., Chicago, Ill.

ELECTRICAL engineer, experienced in power plant, substation, transmission and distribution, operation and maintenance, open for position. PW-599, Electrical World, 7 South Dearborn St., Chicago, Ill.

ELECTRICAL engineer and supervisor, broad experience with utilities in both office and field; desires new connection in responsible capacity such as assistant manager or electrical superintendent, excellent record, available on short notice, salary $3,600. PW-601, Electrical World, Tenth Ave. at 36th Street, New York.

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Will consider connections with the right people and where the future appears to be compensating.

Available in fifteen to thirty days.

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METER TESTER, desires a position where there is a chance for advancement, technical graduate. East preferred. PW-605, Electrical World, Tenth Ave. at 36th St., New York.

OPERATOR and electrician wants position with traction or power company; familiar with rotary converters and remote control systems; capable of making repairs. PW-607, Electrical World, Tenth Ave. at 36th St., New York.

POSITION as manager wanted with the practical personal business experience of twenty years, covering electric contracting, motors, car wiring and storage batteries, employing as high as 15 men; apply for a position with results guaranteed; age 40 years; married with a wife and two children. Address Electrician, 236 Church St., Poughkeepsie, N. Y.

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5—750 Kw. Westg., G. E. and Allis-Chal. Condsg. and Non-Condsg. Bleeder and Mixed Pressure, 60 cy., 3 ph., 2300 v. or other std. voltg., Turbos, with all aux.

5—3125-3500 Kva. Westg., G. E. and Allis-Chal. Condsg. and Bleeder, 60 cy., 3 ph., std. voltage., 3600 r.p.m., Units, with all aux.

1—9300 Kva., G. E. 60 cy., 3 ph., std. voltg., 1800 rev., Condsg. Units with Surface Condr.

EDUCATIONAL

Bliss Electrical School

Condensed course in electrical engineering; complete in one year; for men of character, ambition and limited time; theoretical principles and practical applications of electricity; mathematics, steam and gas engines, mechanical drawing, extensive shop work; construction, installation, testing; fireproof dormitories, dining hall, laboratories, shops; established in 1893; catalog on request. 236 Takoma Ave., Washington, D. C.

U. S. Government

TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., June 21, 1928.—Sealed proposals will be opened in this office at 3 p.m., July 19, 1928, for furnishing all labor and material required for a new engine, generator, etc., in the power house of the national home of lepers at Carville, La. Drawings and specifications may be obtained at this office in the discretion of the Supervising Architect. JAS. A. WETMORE, Acting Supervising Architect.

FREE BULLETIN

THE Motor Repair and Manufacturing Co., 1549 Hamilton Ave., Cleveland, O., are now distributing a new 32-page, illustrated booklet covering their stock of new and rebuilt electrical equipment. Complete description and prices of all items listed are given.

WANTED

WANTED
Boilers
Heine type, or B. & W. preferred; 250 hp., 300 hp., 400 hp. and 500 hp.
Engine Generator Sets, or Turbines
250-400 kw.; also 500-750 kw.
POWER PLANT EQUIPMENT CO., INC.
39 Cortlandt St., New York, N. Y.

3 Phase, 60 Cycle Generators

50 kw., 1,200 r.p.m., 220/440 v., Gen. El.
50 kw., 1,200 r.p.m., 2300 v. General Elec.
60 kw., 900 r.p.m., 2300 v. Electric Mach.
150 kw., 900 r.p.m., 220/440 v., Gen. Elec.
Large stock new and rebuilt motors at Bargain Prices.

V. M. NUSSBAUM & CO., Ft. Wayne, Ind.

GENERAL ELECTRIC VOLTAGE REGULATORS

We have a number of 100 amp. 60 cycle, 2300 volt, type IR8, General Electric Voltage Regulators, complete with operating motor, relay, resistor, contact making voltmeter, current transformer, which we will sell for $200.00 each. At this price there is no excuse for not giving your customers good voltage regulation.

GEORGE SACHSENMAIER CO.
8401 Hegerman St., Holmesburg, Phila., Pa.

FOR SALE

Surplus Electrical Equipment

Eastern and Western Locations
Send for List

THE NEW JERSEY ZINC CO.
Purchasing Dept.
160 Front St., New York, N. Y.

230 Volt D.C. Motors *For Sale*

1—20 hp. Fairbanks-Morse, Type UCPB, compound wound, frame 9, 1730 r.p.m., vertical, serial X-42541.

1—20 hp. Fairbanks-Morse, Type CPB, shunt wound frame 9, 1600 r.p.m., vertical, serial X-42541.

2—20 hp. Gen. Elec., Type RCP-20, compound wound, Form A-147, 1700 r.p.m., horizontal, serials 1351710, 1400222.

SOUTHERN PACIFIC CO.
Purchasing Department
65 Market St., San Francisco.

GENERATOR

2300 volt, 3 phase, 60 cycle, at a bargain price. 200 kw. G. E., pulley and exciter on same shaft. In excellent condition.

NORTHWESTERN PUBLIC SERVICE CO.
Mitchell, South Dakota

The Searchlight Advertising in This Paper

is read by men whose success depends upon thorough knowledge of means to an end—whether it be the securing of a good second-hand piece of apparatus at a moderate price, or an expert employee.

THE BEST PROOF of this is the variety of this journal's Searchlight ads. Without a constant and appreciable *demand* for such machinery or service, by its readers, the market-place which these advertisements represent could not exist for any length of time.

ARE *YOU* USING THE SEARCHLIGHT SECTION?

Appearance—"Very good"
Performance—"Very satisfactory"

Writes a Western Power Co.

Our work for this customer has been on 5 kva. and 15 kva. distribution transformers. Since going into service these have shown no sign of over-heating and voltage readings have been perfect.

Proof of what can be done when burned out transformers are rewound in accordance with factory standards by expert operators, with the proper facilities!

Every unit that leaves our works must pass standard A.I.E.E. insulation tests and must be, in every way, electrically correct. Monthly Bulletin on request.

WE BUY MODERN TYPE TRANSFORMERS—ANY SIZE—ANY QUANTITY

The ELECTRIC SERVICE CO. Inc.
America's Used Transformer Clearing House
212 Walnut Street Cincinnati, Ohio

POWER EQUIPMENT

10,000 Kva. Westinghouse Turbo generator.
3750 Kva. General Elec. turbo generator.
1250 Kva. General Elec. turbo generator.
780 Kva. Westinghouse turbo generator.
2— 750 Kva. NEW General Elec. turbo genraors.
2— 375 Kva. General Elec. turbo generators.
60 Kva. Allis-Chalmers to Moore turbine.
150 Kw. General Elec. 125 volt to Ames unaflow.
125 Kw. General Elec. 125 volt to Skinner unaflow.
156 Kw. Allis-Chalmers A.C. to Skinner unaflow.
185 Kw. General Elec. A.C. to Skinner unaflow.
200 Kw. General Elec. A.C. to Erie Ball 4 valve.
240 Kva. General Elec. A.C. to 4 valve.

Turbo Generators, Various Sizes: Also Large Stock Transformers, Engine Driven Units, Motor Generators, Motors, Dynamos of all Descriptions.

GEORGE SACHSENMAIER CO.
8401 Hegerman St., Holmesburg, Phila., Pa.

LAND

MOTOR BARGAINS

New and Used Selected Bargains

D. C. Motors

H.P.	Make	R.P.M.	Type	
35	G. E.	550	100 B. R.	200
7½	G. E.	850	110 R. C. (New)	

Squirrel Cage Motors (3 Ph., 60 Cy., 220/440)

H.P.	Make	R.P.M.	Type
25	G. E.	1200	K. T.
25	Westghse.	900	C. S.
25	Allis-Chalmers	1200	
25	Robins & Myers	1200	
20	Westghse.	1200	C. C. L.
20	C. W.	1200	
20	G. E.	900	K. T.

Large stock of Motors from ¼ to 300 hp. Also Generators and Motor Generator Sets of all characteristics.

L. J. LAND, 207 Centre St., N. Y. C.

SELECT BARGAINS

Slip Ring Motors, 3 Ph., 60 Cy.

1—200-hp. Westing., Type CW, 220/440 volt, 514 r.p.m.
2—200-hp. Fairbanks-Morse, Type BV, 220/440 volt, 600 r.p.m.
2—150-hp. Gen. Elec. Type 1 Form M 220/440 volt 580 r.p.m.
1—100-hp. Burke Elec. Type EMV, 2200 volt, 900 r.p.m.
1—75-hp. Westing. Type MW, 220/440 volt, 850 r.p.m.
1—75-hp. Gen. Elec. Type MT, 220/440 Volt, 1,800 r.p.m.

Synchronous Motor Generator Sets

5 New Westinghouse 3 Bearing, A.C., Type G, 50 Kva., 220 v., 3 ph., 60 cy., 1200 r.p.m., D.C., Type SK-150L, 125 volt.
Photo, Particulars and Price on Request.

See last week's listing

MOTORS—GENERATORS—TRANSFORMERS AND OTHER ELECTRICAL EQUIPMENT

Belyea Co., Inc., 151 W. 18 St. New York City

REBUILT—GUARANTEED

Advertisements for the
Searchlight Section

Can be received at the New York Office of Electrical World until 10 a.m.

Tuesday

For Issue out Saturday

0139

Get *your* wants into the *Searchlight*

RANDLE

OFFERS BIG BARGAINS IN

Used and Rebuilt Engine Generator Sets, Turbo Generator Sets, Motors, Rotary Converters, Generators, Motor Generator Sets, Engines, Boilers, Steam and Electric Machinery of all kinds also Machine Tools. Send for our new machinery list. Yours for the asking.

The RANDLE MACHINERY CO.
1822 Powers St., Cincinnati, O.

Used Condenser Tubes

9,000 copper tinned; 17 gage; 1½-in. outside diameter; used condenser tubes; approximately 15-ft. long.

Address: W. C. BLAIR
Industrial Engineer
Kansas City Power & Light Company
1332 Grand Avenue, KANSAS CITY, MISSOURI

J. L. HEMPHILL & CO. Inc.

ELECTRICAL ENGINEERS AND EQUIPMENT

801-807 Williams St. North Bergen, N. J.

Telephones: Palisade 2600-2601

MOTOR GENERATOR SETS

1—250 kw., 250 v., G.E. Generator, 3 ph., 60 cy., 2200 v. synchronous motor.
200 kw., 600 r.p.m., 250 v. Gen., 3 ph., 60 cy., 440/2200-v. synchronous motor.
150 kw., 600 r.p.m., 250 v. Gen., 3 ph., 60 cy., 220/440 v. G.E. synchronous motor.
1—125 kw., 250 v. Westinghouse synchronous generator motor set.
1—100 kw., 125 v., D.C., 220/440 A.C., G.E. synchronous motor generator set.
100 kw., 250 v. Gen., 900 r.p.m., 2200 synchronous motor.
1—75 kw., 250 v. Generator, 3 ph., 60 cy., 2200 v. synchronous motor.
1—50 kw., 250 v. Westinghouse, 3 ph., 60 cy., 220 440 v.
1—37 ½ kw., 900 rev., 110 v., D.C., on same base with 60-hp. Lincoln 220 v., sq. cage motor.
10-20-25-40 kw., 125 v. Exciter Sets.
10-20-30 kw. Balancer Sets.
3-5 kw. Battery Charging Sets.

TRANSFORMERS

4—150 kw., 4150 v., 120/240 Pittsburgh Oil Cooled Transformers.
15—5 kw. 30 kw., 3 ph. Pole Type, 2200/1100 440/220/110 G.E.

A. C. GENERATORS

No.	*Kw.*	*Rpm.*	*Volts*	*Ph.*	*Type*
1	400	600	2200	3	GE "B"
1	300	450	2300	3	G.E.P.
1	250	600	440	3	Westg.
2	125	900	2300	3	Cr.-Wh.
2	100	900	2300	3	G.E.
1	75	900	2300	3	G.E.
1	50	1200	220–440	3	G.E.
1	50	1200	2300	3	G.E.
1	30	1200	220–2200	3	G.E.

A. C. ENGINE GENERATOR SET

1—25 kw., 125/250 volt, 3 wire General Electric Gasoline Engine Set, new.

MOTORS—3 PHASE, 60 CYCLE

Hp.	*Rpm.*	*Volts*	*Type*
1 500	600	2200/4150	G.E. syn.
1 500	360	220/440	Westg. HF.
1 400	450	2200	G. E. synch.
1 300	300	2200	Westghse. synch.
1 250	600	220 440	Westg. syn.
1 250	600	440/2200	G. E. syn.
3 200	514	4150/2300	G. E. synch.
1 200	450	440/2200	G. E. sl. rg.
1 180	400	440/2300	Burke sl. rg. 3 brg.
1 150	900	2300	G. E. synch.
4 150	514	2200	Westghse. Slip Ring
1 150	1800	2200	Westg. sq.cg. motor
1 100	900	440 2200	G. E. sq. cg.
1 100	900	220/440/2200	West. sq. cg.
1 75	600	220	G. E. sq. cg.
1 75	720	220	Westg., C. W.
1 75	490	440	Allis-Chal. sl. rg.
1 75	900	2200	G. E. KT.
1 60	1200	220	G. E. sl. rg.
1 60	300	220/440/2300	Fair.-M. Syn.
1 50	600	2200	G. E. MT. sl. rg.
1 50	900	2200	G. E. B.
1 50	1200	220/440	Wagner sl. rg.
1 40	1700	220/440	Westghse. sl. rg.
1 25	900	440/2200	Cr. Wheeler
1 25	1200	440	G. E. K.
1 25	900	220	West C. S.

(2 Phase Motors on request)

BRAND NEW MOTORS

No.	*Hp.*	*Rpm.*	*Volts*	*Type*	
6	7½	900	220–440	Gen. Electric	MT
1	10	1200	220–440	Gen. Electric	MT
2	15	1200	220–440	Gen. Electric	MT
1	15	1200	220–440	Gen. Electric	KT
3	25	600	220–440	Gen. Electric	KT
2	25	900	220–440	Gen. Electric	KT
1	30	900	220–440	Gen. Electric	KT
2	30	1200	220–440	Gen. Electric	KT
1	40	1200	220–440	Gen. Electric	MT
1	40	900	220–440	Gen. Electric	KT
1	40	1200	220–440	Gen. Electric	KT
1	60	720	220–440	Gen. Electric	KT

D.C. GENERATORS—250 VOLT

No.	*Kw.*	*Rpm.*	*Type*
1	200	500	West.
1	150	600	G. E.
1	125	600	Cr. Wheeler
1	100	720	G. E.
1	75	450	Diehl
1	50	600	Westghse.
1	30	1000	Westghse.

(Smaller sizes on request)

D. C. GENERATORS—125 VOLT

5, 10, 20, 22, 35, 50, 2-100 kw.
3—21 kw. 1250 r.p.m. Sprague

D. C. MOTORS—230 VOLTS

No.	*Hp.*	*Rpm.*	*Type*
1	200	550	West.
1	150	1100	West. SK
1	125	550	Cr. Wheeler
1	100	625	Westg. type S
1	80	500	Allis-Chalmers
2	75	475	Westg. type S
1	50	560	Westghse SK
1	50	200	Diehl
1	50	650	Sprague
1	40	400	Diehl
1	40	1300	Diehl
1	35	200	Diehl
1	35	700	Cr. Wheeler
1	35	420	Diehl
1	20	665	Diehl
1	20	200	Diehl
1	20	900	Diehl
2	15	1050	Cr. Wheeler CM
8	10	375/750	Westg. S. var. sp.
	10	1350	Rochester

(Smaller sizes on request)

D. C. MOTORS—125 VOLT

1	125	575	G. E.
1	100	600	G. E.
1	80	600	G. E.
3	25	1200	Sprague
1	20	650	G. E.
1	15	775	SK Westghse.

How much have you figured that CHANGE-OVER *job is going to cost you?*

ARE you hesitating about making that change-over because your estimated cost of the work has brought you to a figure that seems exorbitant?

Perhaps you have overlooked several possibilities where economies could be effected through systematic handling of the work?

Why not let our engineers re-figure the cost of your contemplated change-over with their background of years of experience in making successful change-overs for many of the largest Electric Light and Power Companies of the East.

Most likely they can show you where you can save money. This service incurs no obligation.

We specialize in changes from D. C. to A. C. from 2 to 3 phase, from 25 to 60 cycle.

GUARANTEE

All apparatus sold, new or used, carries our guarantee to correct by repair or replacement all electrical and mechanical defects occurring in such apparatus, for a period of one year after date of shipment.

BERGER BROS.
(F. O. B. Rochester)

We maintain an extensive stock of new and used guaranteed electrical equipment for our change-over service, from which we can quickly meet your needs for dependable new or used equipment at favorable prices. See our advertisement in the July 14th issue for bargains in 25 cycle items.

BERGER BROTHERS

91 St. Paul St. Rochester, N. Y.

A. C. Engine Units

1—300 kw., 375 kva., General Electric 3 ph., 60 cy., 240/480 v., 150 r.p.m. Alternator, direct connected to 21x30 side crank 4-valve heavy duty Erie Ball Engine. Unit installed new in 1923—exceptional condition, instant shipment.

1—300 kw. Allis-Chal. 3 ph., 60 cy., 240/480 v., 150 r.p.m. direct connected to 20x32 Rice & Sargent 4-valve engine.

1—180 kva. General Electric 3 ph., 60 cy., 2300 v. (can reconnect for 240 or 480 v.), speed 200 r.p.m. direct connected to 17½x20 Ames Unaflow engine. Built in 1922.

1—150 kva. Westg. 3 ph. 60 cy. 2300 v. (can reconnect for lower voltage) 225 r.p.m. direct connected to 17x18 right-hand Ames Unaflow engine. Built in 1923.

1—125 kw. Ft. Wayne 3 ph. 60 cy. 2300 v. (can reconnect for lower voltage) 225 r.p.m. direct connected to 14½x16 Harrisburg Fleming 4 valve engine.

1—90-kw. Ft. Wayne 3 ph. 60 cy. 2300 v. (can reconnect for lower voltage) 277 r.p.m. direct connected to Erie Ball side crank single valve automatic engine.

A. C. Turbo Units

1—12,500 kva., 10,000 kw. Westinghouse 3 ph., 60 cy., 2300 v. 1800 r.p.m. condensing.

1—3125 kva., 2500 kw. G. E. 3 ph., 60 cy., 2300 v., 3600 r.p.m. surface condenser.

1—1562 kva., 1250 kw. G. E. 3 ph., 60 cy., 2400 v., 3600 r.p.m. surface condenser.

2—750 kva., 600 kw., G. E. 3 ph., 60 cy., 2300 v., 3600 r.p.m. surface condensers and spray pond equipment.

1—375 kva., 300 kw. G. E. 3 ph., 60 cy., 2300 v., 3600 r.p.m. condensing.

1—187 kva., Westinghouse 3 ph., 60 cy., 480 v., 3600 r.p.m. non condensing.

1—75 kva., Burke Moore 3 ph., 480 v., 3600 r.p.m. non-condensing.

A. C. Motors—Slip Ring

3—400-hp. Gen. Elec. type MT 3 ph., 60 cy., 2200 v., 450 r.p.m. each complete with controller, resistance, starting panel and rails, 3 bearing type.

Send for Full List Electrical and Steam Machinery of Every Description.

ARCHER & BALDWIN, Inc.

126 Liberty St., New York City Telephone—Rector 4025

HIGH GRADE STANDARD EQUIPMENT

Slip Ring Motors—3 Ph., 60 Cy.

Hp.	Volts	Make	Speed
400	2200-550	Whse.	450
225	220-440	G.E.	450
200	220-440	G.E.	600
150	220-440	G.E.	720
150	220-440-550	G.E.	600
125	2200	G.E.	1200
100	2200	G.E.	900
100	440-220	G.E.	720
100	440-220	G.E.	600
100	440-220	G.E.	900
175	220-440	G.E.	720
75	440-220	G.E.	900
75	550	G.E.	720
50	550	G.E.	514
50	220-440	G.E.	900
30	220-440	Whse.	900
25	220-440	G.E.	1200
25	2200	G.E.	1200
20	220-440	G.E.	900
20	550	Whse.	600

Synchronous Motors—3 Ph., 60 Cy.

Hp.	Volts	Make	Speed
240	2200-440	G.E.	720
135	2200-550	G.E.	900
110	2200	G.E.	900
80	2200-440-220	G.E.	1200

Direct Current Motors

Hp.	Volts	Speed	Make	Type
225	230	760	Westghse.	SK
150	230	875	General Electric	DLC
130	115	1200	General Electric	RC
125	115	900	General Electric	RC
60	230	1050	General Electric	RC
35	115	700	General Electric	DLC
30	115	1150	General Electric	RC

Direct Current Generators

200	250	850	Westghse.	SK
125	125	1050	G.E.	RC
90	125	1150	General Electric	RC
75	250	850	G.E.	CLB
65	125	800	Westghse. S	K
35	125	850	General Electric	DLC

Sq. Ca. Motors—3 Ph., 60 Cy.

150	440-220	G.E.	1200
100	220-440	G.E.	1800
100	220-440	G.E.	900
75	220-440	G.E.	900
75	220-440	G.E.	720
50	220-440	G.E.	900
50	550	G.E.	900
40	220-440	G.E.	1200

Motor Generator Sets

1—220-kw., 250-v., 514-r.p.m., Westghse, D.C. with 300-kva., 2200-v., 3-ph., 60-cy., syn.
1—150-kw., 250-125-v., 3 wire, 720-r.p.m., Crocker-Wheeler Generator connected to 225-hp., 2200-440-v., 3-ph., 60-cy., synchronous G. E. motor.
1—100-kw., 125-v., 1200-r.p.m., G.E. Type MPC.; D.C. Generator connected to 125-Kva. G.E. Type ATI. 440-220-v., 3-ph., 60-cy., syn. motor.

A. C. Generators

1—200-kw., 720-r.p.m., 2200-440-220-v., 3-ph., 60-cy., G. E. belted exciter.
1—187-kva., 720-r.p.m., 2200-440-220-v., 3-ph. 60-cy., G. E. belted exciter.
1—112½-kva. 900-r.p.m., 2200-v., 3-ph., 60-cy., G. E. direct connected exciter.
1—100-kw., 900-r.p.m., 2200-v., 3-ph., 60-cy., G.E. belted exciter.
1—75-kw., 900-r.p.m., 480-240-v. 3-ph., 60-cy., G. E. belted exciter.
1—75-kw., 1200-r.p.m., 2200-480-240-v., 3-ph., 60-cy., G. E. belted exciter.
1—37½-kva., 1200-r.p.m., 2300-440-220-v., 3-ph. 60-cy., G. E. belted exciter.

STEPHEN HALL & CO., INC., 7th and Adams Sts., HOBOKEN, N. J.

Eng. Sets For Sale—Etc.

750 — 1000 — 1250 — 1650 KW.
240—480—2300 V. 60 cy. 3 ph.
Bleeder and Low Press. Turbos
600 — 750 — 1000 — 1250 KW.
75—165 KW. Gas Eng. Sets. 240V. 3ph.
NEW — 1½ TON ELECTRIC FURNACE
New 1001 H.P. 200 lb. Boiler. ASME.
3—New 200 H.P. Oil Eng. Diesel
TRANSFORMERS — MOTORS, ETC.
ROSS POWER EQUIPMENT CO.
Indianapolis, Ind.

FOR SALE

TURBO-GENERATOR

G. E. 4000-kw., 2300-v.; condenser, Alberger low-head jet type; step-up transformer, 2300/33000-v.; rotaries, 4—400-kw., 600-v., 3-ph.; exciters, 3—100-kw., 125-v. engine driven; motor; 150-hp., 2300-v. synchronous belted; generator; 150-kw. revolving-field belted; switchboard, piping, cables, etc. All 25-cy. Available at once.

SCIOTO VALLEY RWY. & PWR. CO.
Columbus, O.

VALUE—*that can only be measured by Service!*

The true value of Rockford Rebuilt Power Equipment is in greatest evidence when it's in your service. Only then can you appreciate that it has been rebuilt properly by the lack of constant repair bills—ask the man who has bought from us! Look over this partial list of—

GUARANTEED REBUILT POWER EQUIPMENT

ENGINE GENERATORS

Alternating Current
3 Ph—60 Cy—220/440/2300 Volt

50 KW. Gen. Elec. Type ATB 300 r.p.m. Generator, direct connected to 10 x 12 Brownell engine, belted exciter and switchboard.
75 KW. Elec. Machinery Generator, direct connected to 9 x 16 Skinner Engine, belted exciter and switchboard.
125 KW. Westinghouse 225 r.p.m. Generator, direct connected to 11 x 18 and 17½ x 18 Buckeye Tandem Compound Engine, belted exciter.
180 KW. Gen. Elec., Type TRE, 120 r.p.m. Generator, direct connected to 12 x 24 x 36 Nordberg, 4-valve Corliss cross compound engine, belted exciter.
240 KW. Gen. Elec. 200 r.p.m. Generator, direct connected to 20 x 22 Ironton Engine, belted exciter.

Direct Current—250 Volts

50 KW. Crocker-Wheeler Type CCD, 275 r.p.m. Generator, direct connected to Chandler-Taylor Engine.
100 KW. Crocker-Wheeler, Type CCD, 650 r.p.m. Generator belted to 15 x 16 Chase Single Valve Engine.

FREQUENCY CHANGER

15 KVA. Gen. Elec., 3 Phase, 60/120 cycle, 220 Volt, 1,200 r.p.m., direct connected to 15 HP., 3 Phase, 60 cycle, 220/440 volt Gen. Elec., Type KT motor on common base with starter.

TURBO GENERATORS

Alternating Current
3 Phase—60 Cycle—220/440 Volt

62 KVA. Westinghouse unit. Generator geared to non-condensing turbine, direct connected exciter.
500 KVA. Westinghouse unit. Generator direct connected to mixed pressure turbine, direct connected exciter.

Direct Current

150 KW. Westinghouse unit, 125/250 Volt, 3 Wire Generator, geared to non-condensing turbine with switchboard.

Also A Large Stock of

Belted Generators, Motors, Air Compressors, Transformers, Engines, Pumps, etc.
All lished in Bulletin No. 34. Write for your copy.

ROCKFORD POWER MACHINERY CO.

620-6th St., Rockford, Ill. Phone, Main 3741

If there is anything you want—

or something you don't want that *other* readers of this paper can supply—or use—advertise in the

SEARCHLIGHT SECTION

Somebody is always looking for something to meet certain business needs. Some men in charge of plant operations may be in the market for good used equipment—others may have just what they want, to sell. Some may require a man of unusual qualifications for a particular position—that man may be another reader of this paper!
Put the Searchlight Section to work for you under any of the following classifications—to fill your business needs.

Agencies Wanted
Agents Wanted
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Buildings For Sale
Business Opportunities
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Educational Courses
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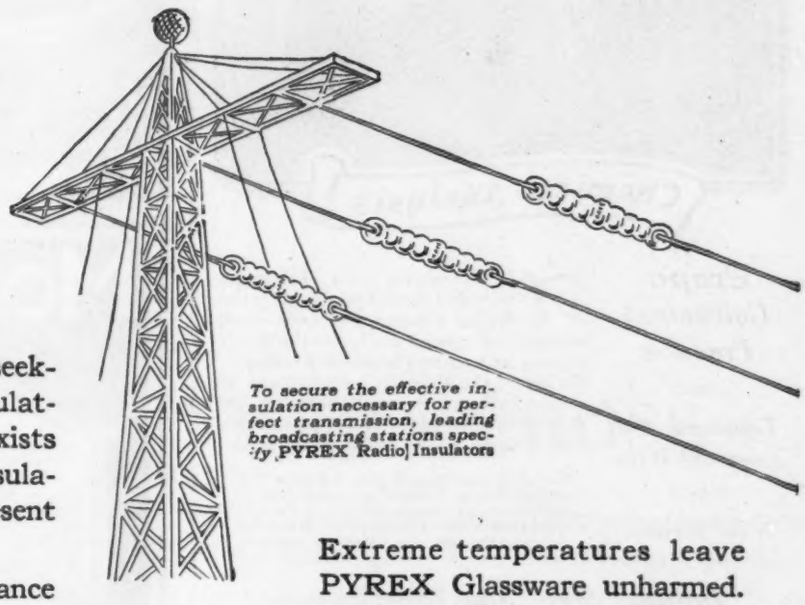
Exchanges
For Rent Items
Franchises
Industrial Sites
Miscellaneous Wants
New Industries Wanted
Partners Wanted
Patents For Sale
Patent Attorneys
Plants For Sale
Positions Vacant
Positions Wanted
Property For Sale
Receivers' Sales
Representatives Wanted
Salesmen Wanted
Work Wanted
Etc., Etc., Etc.

Have you investigated this unique insulating material?



To secure the effective insulation necessary for perfect transmission, leading broadcasting stations specify PYREX Radio Insulators

PERHAPS you are actively seeking a more satisfactory insulating material. Perhaps there exists the need for more efficient insulation than afforded by your present equipment.

In any case, the performance record of *PYREX Glassware merits your most careful investigation.

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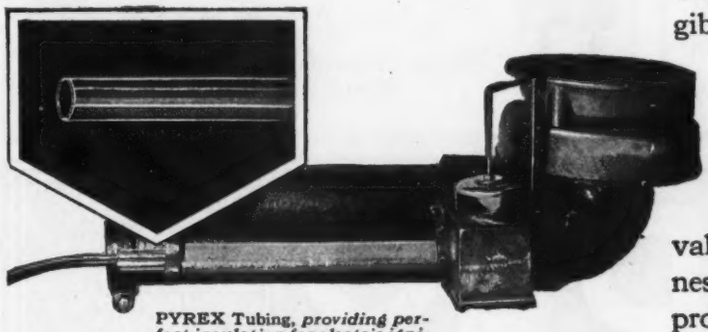

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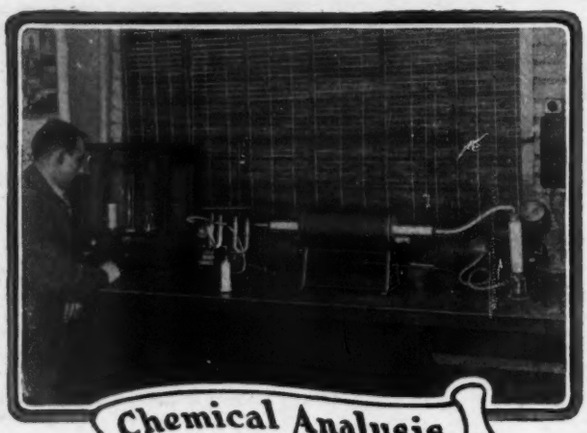

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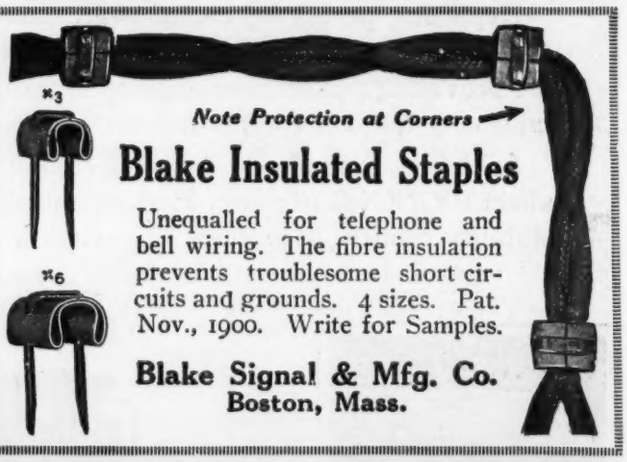

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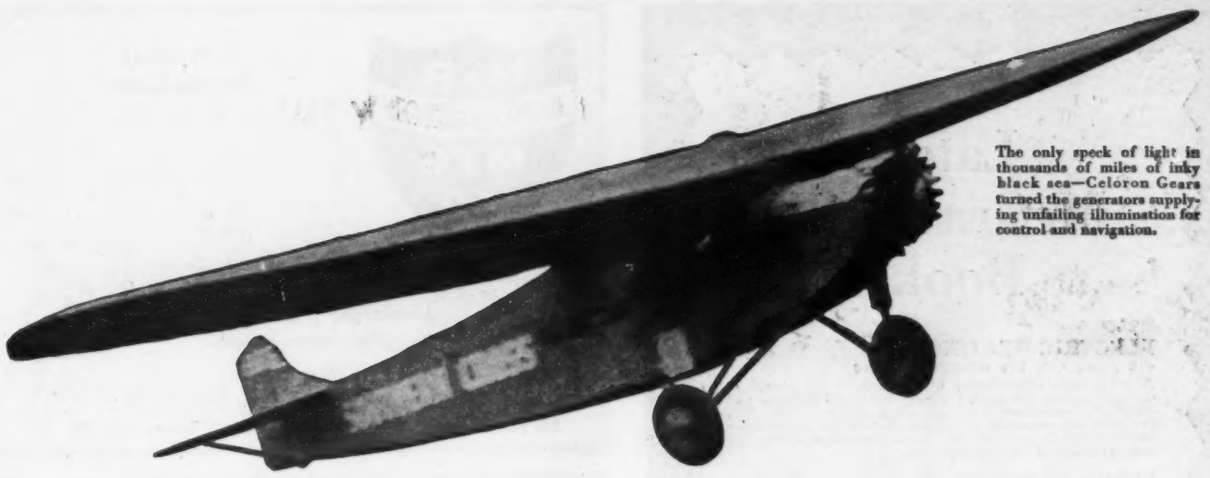

The only speck of light in thousands of miles of inky black sea—Celoron Gears turned the generators supplying unfailing illumination for control and navigation.

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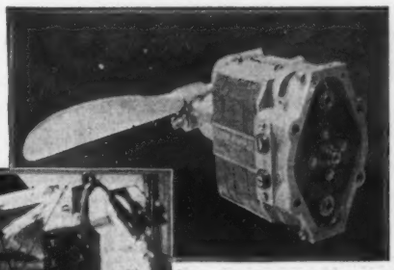

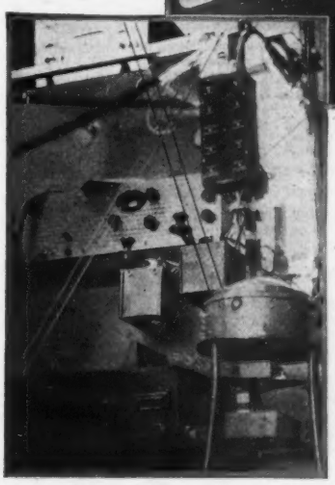

Plane Dives—Generators Shriek—Celoron Gears Hold On

During those anxious hours when the gallant Southern Cross pitched downward in great dives through depressing air currents and the plane's speed multiplied, the wind-driven generators (built by the Harris Electric Company of San Francisco) told the story in wild radio whines.

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Many Records Broken

The transmitting and receiving sets, built by Heintz & Kaufman of San Francisco, in which Celoron was used. The transmitter is so constructed that it would actually work effectively under water.

Short-wave transmission was received in San Francisco direct from The Southern Cross the day the plane landed in Suva, 5,538 miles away.

7,300 miles over sea. Through treacherous tropic storms and heat. Death stalking every wave. Four lives hanging upon a single, invisible thread—a radio beam, guiding them to security through endless surging Pacific wastes.

For such a task—for the positive assurance that in spite of the elements, this equipment would not fail through faulty insulation—it is no wonder that Celoron Insulation was used in all three of the giant Fokker's transmitting and receiving sets.

It is only natural that Celoron Silent Gears—strong, wear-resisting and dependable—should have been selected to turn the generators supplying the endless flow of vital energy to the radio equipment and to the plane's lighting system.

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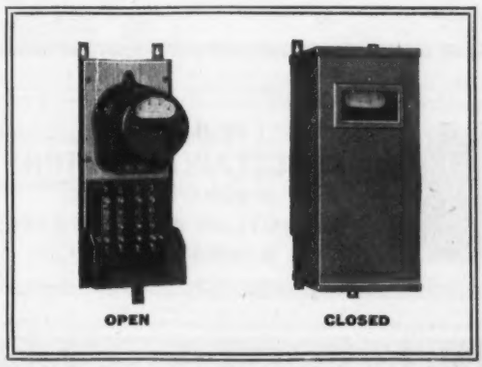

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Assembly includes 60-ampere test block; sealing stud at bottom of box; meterboard of wood for mounting which permits use of meters with differently spaced mounting holes; two heavy steel mounting straps welded to back of box, offset to hold box away from wall. Can be furnished without test block if desired. Finished in clear enamel.

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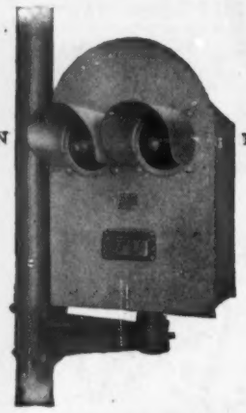

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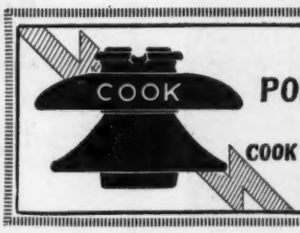

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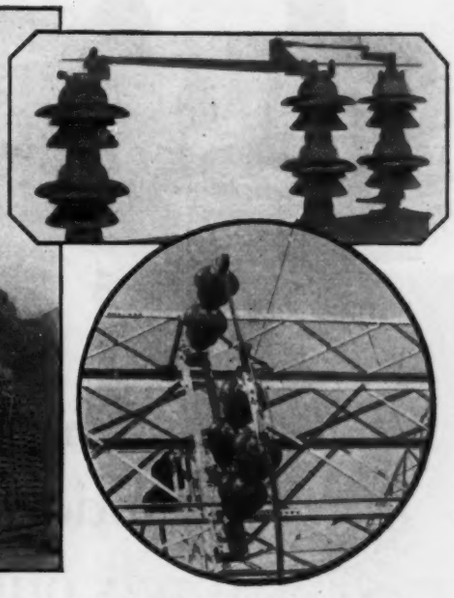

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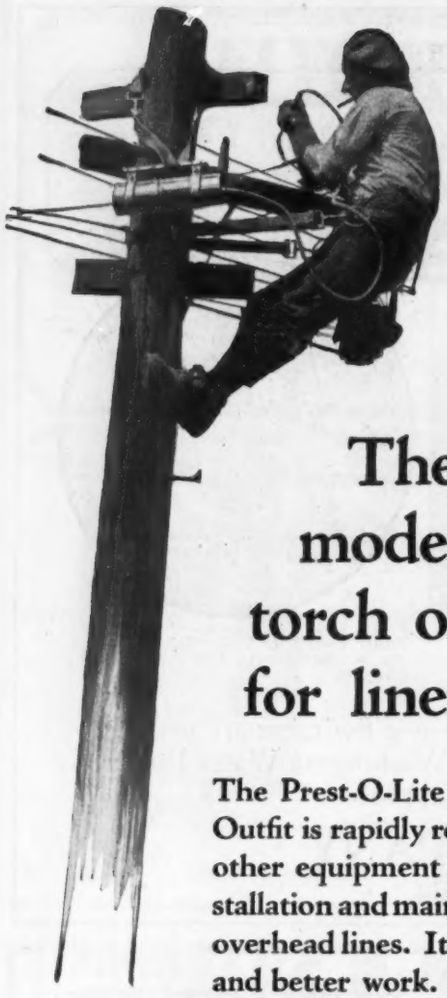

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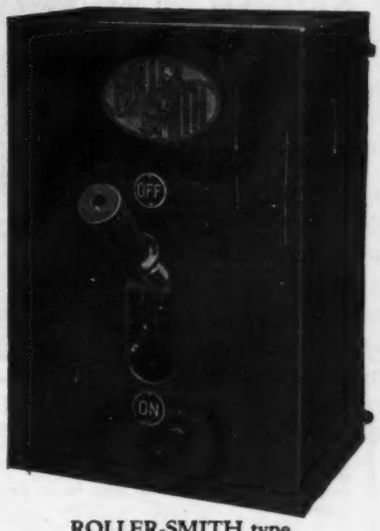

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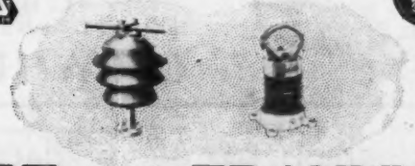

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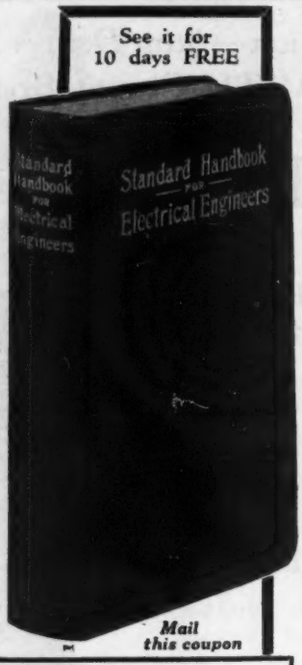

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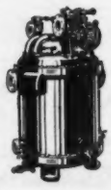

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The Edge Moor Bent Tube Boiler illustrated on this page is the result of our experience with its predecessor and with the Single Pass Boiler. Its design incorporates the features that have proved most desirable in fifteen years of successful operation—plus the refinements and improvements suggested by practical experience.

The construction of drums and tubes in the Bent Tube Boiler is similar to that of the steamer section of the Single Pass Boiler, which has made an excellent record in central station service. There is no part of the Bent Tube Boiler that is radical and untried. It is soundly designed and soundly built.

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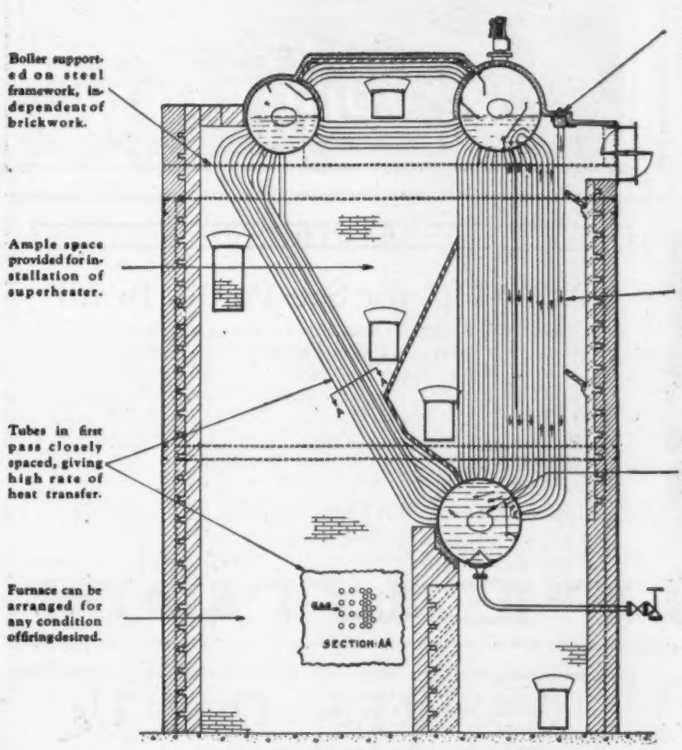
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Feed water introduced into separate forged steel header.
Arrows indicate progressive flow of feed water into main boiler circulation.
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SECTION AA

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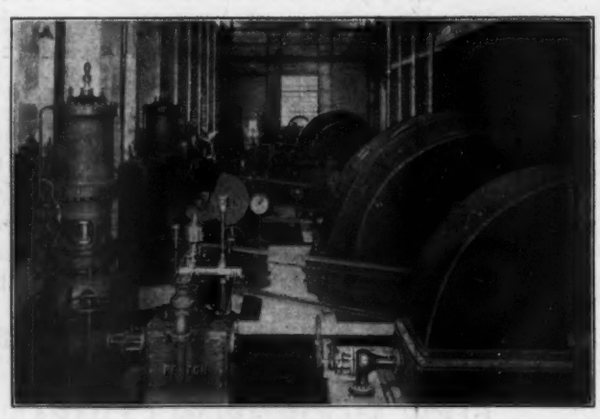

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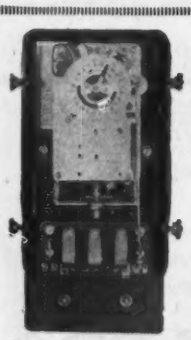

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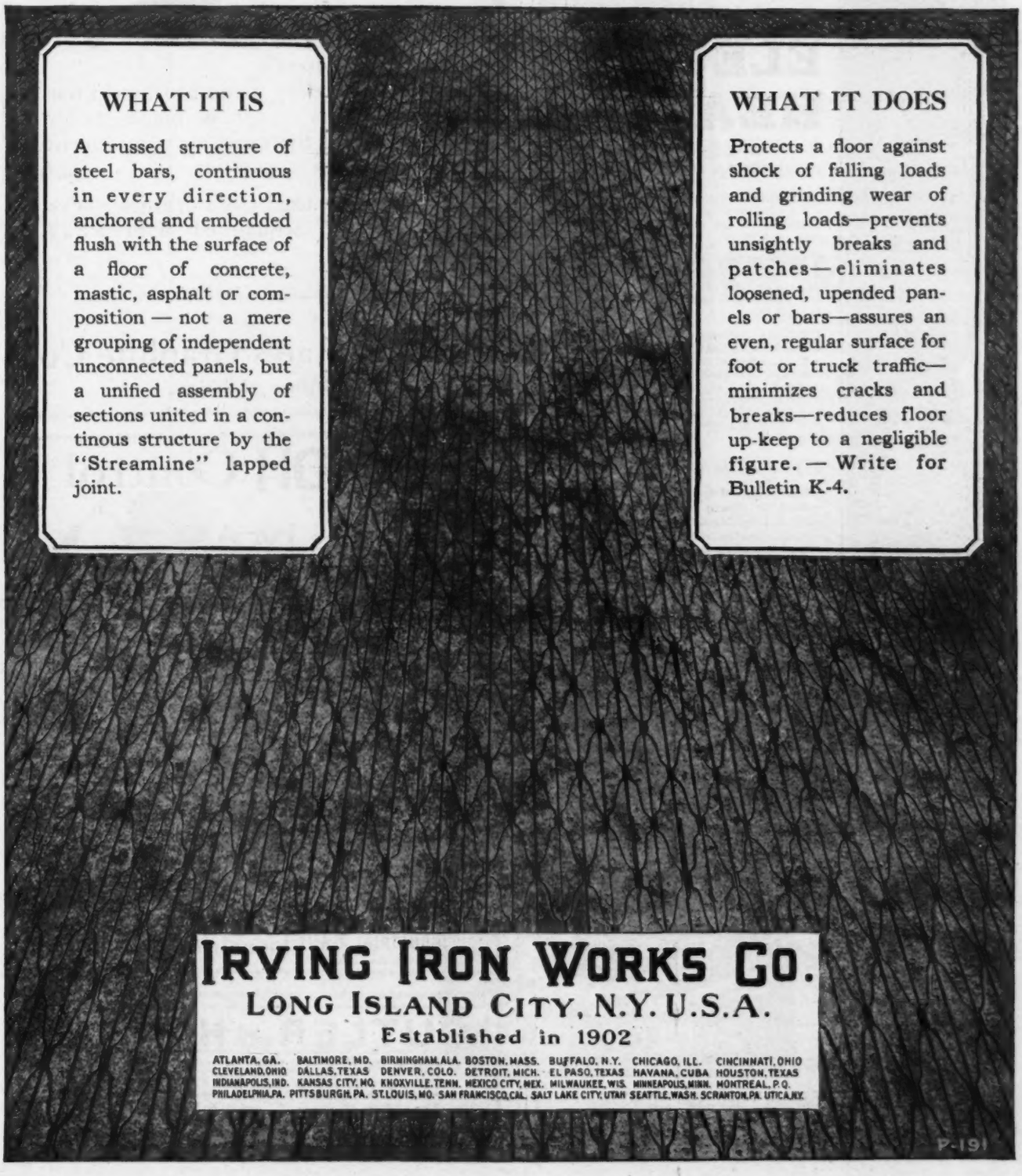

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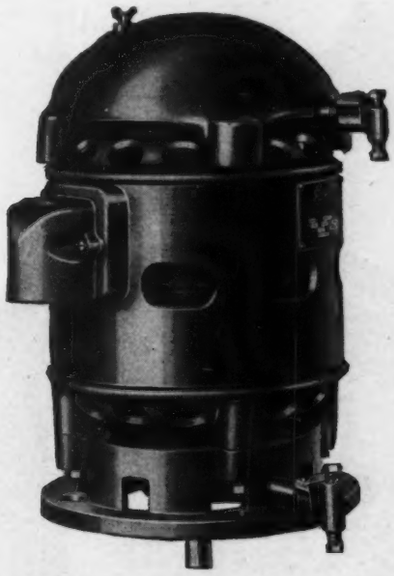

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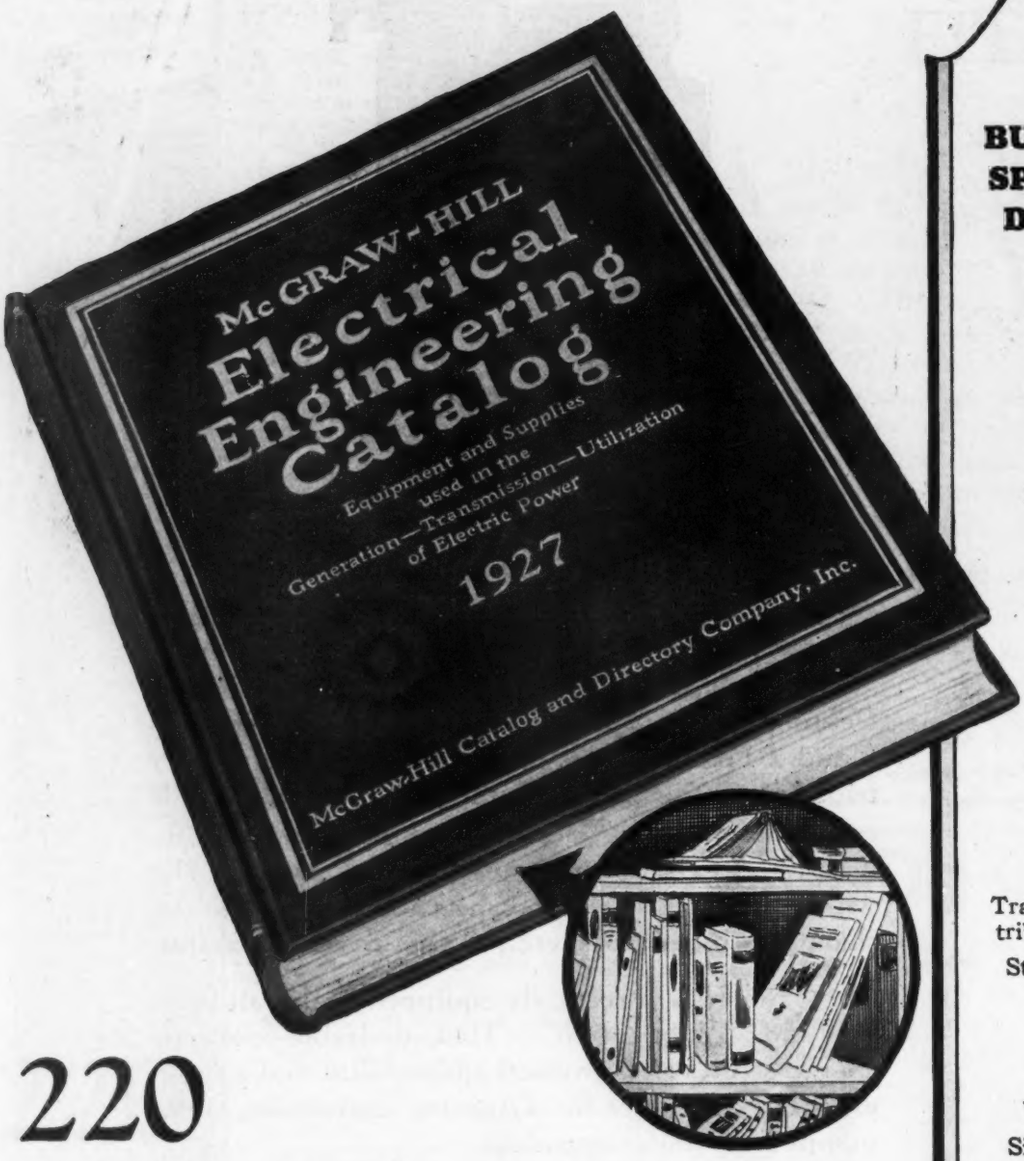

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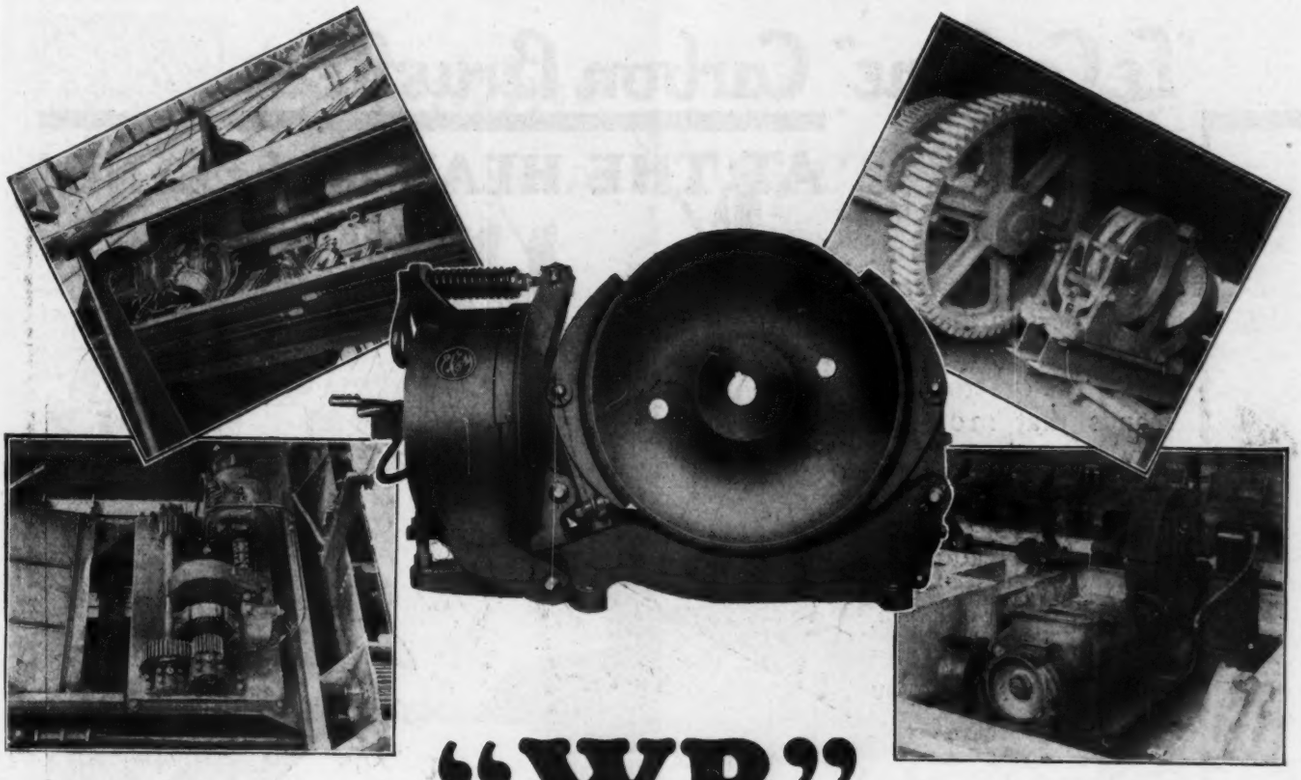

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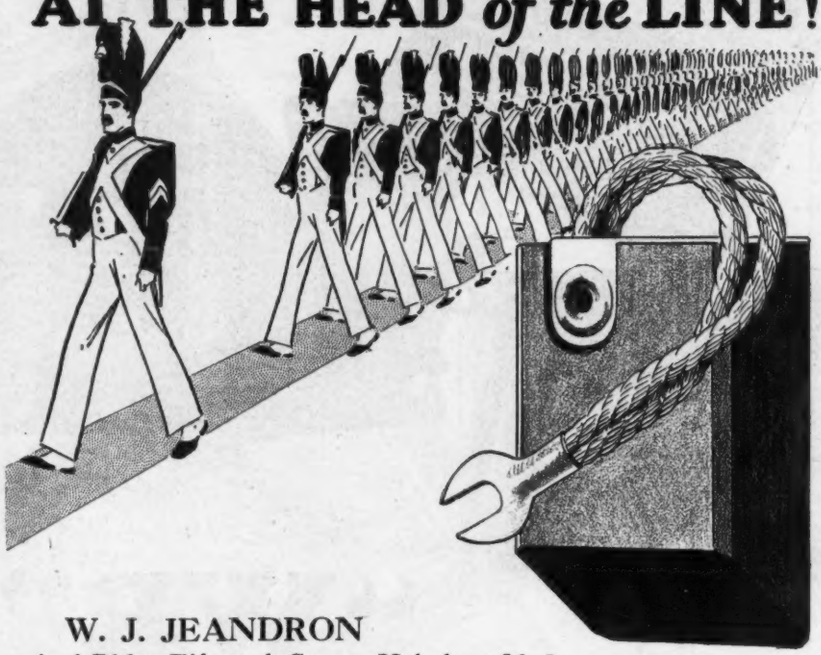

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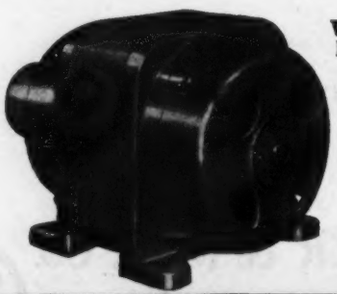

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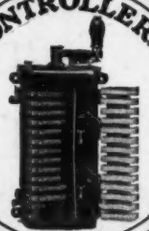

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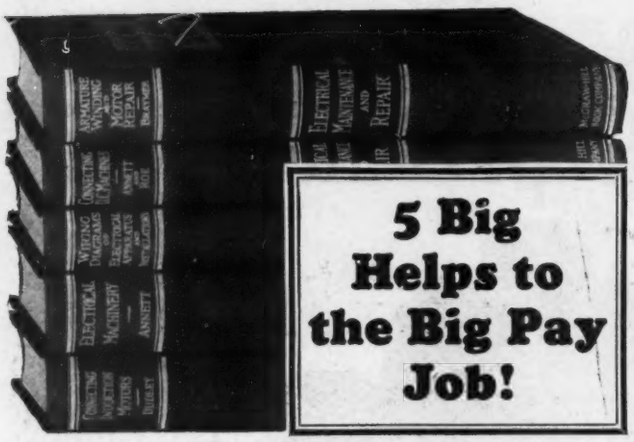

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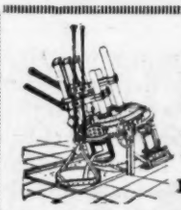

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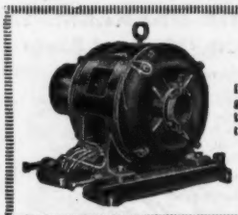

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SO keen is competition in the marketing of portable electric appliances, that any highly successful organization must concentrate vigorously on the *selling* end of its business. *Manufacture*, in many cases, may be an undesirable—and unprofitable—burden, involving heavy overhead and expense.

This is particularly true where the appliance is 80% to 90% motor, and where the separate manufacture of motor and appliance means duplication of assembly, inspection, packing and shipping costs.

Domestic Electric, through its new departments of Appliance Design and Appliance Manufacture, can most advantageously serve such organizations. There is a direct saving in production cost, and higher standards of operating efficiency are also assured, where both appliance and motor are engineered and built as a unit, by an organization that has devoted many years exclusively to the application of fractional horsepower motors to household and industrial appliances.

With our new facilities, we are prepared not only to design certain types of appliance from "the idea" to the finished product, but to re-design existing models—and to manufacture and assemble motor and appliance, packed and ready for shipment.

In actual operation, Domestic will continue to function as a department of the businesses it serves, devoting all its energies to highest quality at lowest cost, and most dependable performance of the appliance in the hands of the user. We shall gladly give complete information on request; and we cordially invite personal inspection of the enlarged facilities offered by this organization.

THE DOMESTIC ELECTRIC COMPANY
7209-25 St. Clair Ave. - - - Cleveland, Ohio

Domestic
FRACTIONAL HORSEPOWER
Electric Motors

INDUSTRY'S · BIGGEST · LITTLE · THING

WHAT AND WHERE TO BUY

Equipment, Apparatus and Supplies Advertised in This Issue with Names of Manufacturers

Readers interested in any articles not listed in these pages are cordially invited to inform us of their wants and every effort will be made to put them in touch with the proper manufacturers.

This index is published as a convenience to the reader. Every care is taken to make it accurate, but ELECTRICAL WORLD assumes no responsibility for errors or omissions.

Readers' Service Department—ELECTRICAL WORLD, Tenth Avenue at 36th Street, New York

Air Compressors
Allis-Chalmers Mfg. Co.
General Electric Co.

Air Preheaters
Babcock & Wilcox Co.
Blaw-Knox Co.

Alternators
Burke Elec. Co.

Anchors, Guy
Hubbard & Co.
Kearney Corp., James R.
Matthews Corp., W. N.
Oliver Iron & Steel Co.
Truscon Steel Co.

Apparatus, Testing
Roller-Smith Co.

Arc Welders, Portable
Lincoln Electric Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

Armature Repair Machinery
Electric Service Supplies Co.

Asbestos
Johns-Manville Corp.

Babbitts
Westinghouse Elec. & Mfg. Co.

Batteries
Dry
Graybar Electric Co.
Storage
Electric Storage Battery Co.
Gould Storage Battery Co., Inc.

Battery Charging Apparatus
Cutler-Hammer Mfg. Co.
General Electric Co.
Wagner Electric Corp.
Westinghouse E. & M. Co.

Bearings
Armature
Timken Roller Bearing Co.
Ball
Fafnir Bearing Co.
Roller
Timken Roller Bearing Co.
Thrust
Timken Roller Bearing Co.

Bells, Conduit
Electrical Engineers Equip. Co.
G. & W. Electric Spec. Co.

Blocks, Fuse
Westinghouse Elec. & Mfg. Co.

Boiler Room Instruments
(see Instruments)

Boilers
Heating
Edge Moor Iron Co.
Water Tube
Babcock & Wilcox Co.
Edge Moor Iron Co.

Bolts
Carriage
Hubbard & Co.
Oliver Iron & Steel Co.
Crossarm
Hubbard & Co.
Oliver Iron & Steel Co.
Expansion
Hubbard Co.
Oliver Iron & Steel Co.
Machine
Hubbard & Co.
Oliver Iron & Steel Co.

Bonds, Rail
American Steel & Wire Co.
Copperweld Steel Co.
Ohio Brass Co.

Books, Technical
McGraw-Hill Book Co., Inc.

Boosters
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse E. & M. Co.

Boxes
Fuse
General Electric Co.
Schweitzer & Conrad, Inc.
Junction and Outlet
General Electric Co.
Westinghouse E. & M. Co.
Meter and Service
General Electric Co.

Braces, Crossarm
Hubbard & Co.
Oliver Iron & Steel Co.
Truscon Steel Co.

Brackets and Pins, Metal
Hubbard & Co.
Oliver Iron & Steel Co.

Brakes, Electric
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.

Brushes
Dynamo and Carbon
Jeandron, W. J.
Motor and Generator
United States Graphite Co.

Buckets, Clamshell
Blaw-Knox Co.

Buildings, Steel
Blaw-Knox Co.
Truscon Steel Co.

Bus Bar Supports
Electrical Engineers Equip. Co.
Electric Power Equip. Corp.
General Electric Co.
Ohio Brass Co.
Railway & Indus. Eng. Co.
Schweitzer & Conrad, Inc.
Westinghouse E. & M. Co.

Bushings, Porcelain
Ohio Brass Co.

Cable (See Wires & Cables)

Cable Accessories, End Bells and Racks
Electrical Engineers' Equip Co.
General Electric Co.
Hubbard & Co.
Oliver Iron & Steel Co.
Standard Underground Cable Co.
Truscon Steel Co.

Cable and Splicing Material
G. & W. Elec. Spec. Co.

Cable Boxes, Underground
G. & W. Electric Spec. Co.

Cabling Machinery
American Ins. Machy. Co.

Caps, Ground
Hubbard & Co.
Oliver Iron & Steel Co.

Carbonization Eqpt. Low Temperature
International Coal Carbonization Co.

Carbon Products
United States Graphite Co.

Catenary Trolley Materials
Ohio Brass Co.

Cell Structures
Deceleco, Inc.

Cement, High Temperature
Johns-Manville Corp.

Circuit Breakers
General Electric Co.
Pacific Electric Mfg. Co.
Roller-Smith Co.
Schweitzer & Conrad, Inc.
Sundh Electric Co.
Westinghouse E. & M. Co.
Air
I. T. E. Circuit Breaker Co.
Enclosed Air
I. T. E. Circuit Breaker Co.

Clamps
Cable, Supporting
Matthews Corp., W. N.
Ground Connection
Railway & Industrial Engr. Co.
Sherman Mfg. Co., H. B.
Guy
Hubbard & Co.
Matthews Corp., W. N.
Oliver Iron & Steel Co.
Truscon Steel Co.
Trolley
Ohio Brass Co.

Cleats
Blake Signal & Mfg. Co.
Imperial Porcelain Co.
Square D Co.
Thomas & Sons Co., R.

Clevises
Hubbard & Co.
Oliver Iron & Steel Co.

Clips
Cable
Hubbard & Co.
Oliver Iron & Steel Co.
Pittsburgh Transformer Works

Clutches, Magnetic
Cutler-Hammer Mfg. Co.

Coatings
Anti-Corrosive
Dampney Co. of America
Boiler
Dampney Co. of America
Protective
Dampney Co. of America
Tube
Dampney Co. of America

Coils
Choke
Dudlo Mfg. Co.
Electrical Engineers Equip. Co.
General Electric Co.
Ry. & Industrial Eng. Co.
Schweitzer & Conrad, Inc.
Westinghouse E. & M. Co.
Magnet
Dudlo Mfg. Co.
Transformer
Dudlo Mfg. Co.

Compensators
Electric Controller & Mfg. Co.

Compressors, Air
Allis-Chalmers Mfg. Co.

Concrete Armoring, Surface
Irving Iron Works

Condensers
Static
Westinghouse Elec. & Mfg. Co.
Steam
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse E. & M. Co.
Wheeler Mfg. Co., C. H.

Conduits, Fibre
Johns-Manville Corp.
Fibre Conduit Co.

Conduits, Interior
Johns-Manville Corp.

Conduits, Underfloor
Johns-Manville Corp.

Conduit, Underground
Johns-Manville Corp.
National Fireproofing Co.

Conduits, Flexible, Steel, Rigid
General Electric Co.

Conduit, Rigid, Aluminum
Aluminum Co. of America

Connectors and Terminals
Electric Power Equip. Corp.
Electrical Engineers Equip. Co.
General Electric Co.
Railway & Industrial Engr. Co.
Sherman Mfg. Co., H. B.
Westinghouse E. & M. Co.

Connectors, Solderless Service
Kearney Corp., James R.

Contact Rail Material
Electric Service Supplies Co.
Ohio Brass Co.

Contactors
Electric Controller & Mfg. Co.

Contractors, Transmission Line
Hoosier Engineering Co.

Control, Electric Valve
Cutler-Hammer Mfg. Co. (Dean)

Control, Railway
Westinghouse Elec. & Mfg. Co.

Control Systems
Electric Controller & Mfg. Co.

Controllers
Automatic
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
Crane
Electric Controller & Mfg. Co.
Motor
General Electric Co.
Industrial Controller Co.
Sundh Electric Co.
Union Electric Mfg. Co.
Westinghouse E. & M. Co.

Converters
Booster
Allis-Chalmers Mfg. Co.
Westinghouse Elec. & Mfg. Co.
Rotary
Wagner Electric Corp.
Synchronous
Westinghouse Elec. & Mfg. Co.

Cord
Flexible
Simplex Wire & Cable Co.
Portable, Rubber Covered
Simplex Wire & Cable Co.

Cords and Cables, Flexible
Okonite Co.
Simplex Wire & Cable Co.

Couplings, Flexible
Smith & Serrell

Couplings, Rigid (Shaft)
Smith & Serrell

Crane Motors
General Electric Co.
Westinghouse E. & M. Co.

Cross-Arms
Graybar Electric Co.
Hubbard & Co.
Oliver Iron & Steel Co.
Ry. & Industrial Eng. Co.
Thomas & Sons Co., R.
Truscon Steel Co.

Cutouts
Bowie Switch Co.
General Electric Co.
Matthews Corp., W. N.
Pacific Electric Mfg. Co.
Westinghouse Elec. & Mfg. Co.
High Tension
High Tension Elec'l Spec. Co.
Plug
Kearney Corp., James R.
High Tension
Schweitzer & Conrad, Inc.
Series
G. & W. Elec. Spec. Co.
Transformer
Wagner Electric Corp.

Devices, Protective
Electrical Engineers Equip. Co.
Electric Power Equip. Corp.
General Electric Co.
Roller-Smith Co.
Ry. & Industrial Eng. Co.
Schweitzer & Conrad, Inc.
Westinghouse E. & M. Co.

Doors for Bin and Switch Compartments
Deceleco, Inc.
Johns-Manville Corp.

Drills
Rock
Hubbard & Co.
Oliver Iron & Steel Co.

Economizers
Babcock & Wilcox Co.

Ejectors
Westinghouse Elec. & Mfg. Co.

Electric Railway Materials
Ohio Brass Co.

Electrification Materials, Steam Road
Ohio Brass Co.

Enameling Machinery, Wire
American Insulating Machinery Co.

Engineers, Consulting
(See Directory of Engineers)

Engineers, Transmission Line
Hoosier Engineering Co.

Engines
Gas
Allis-Chalmers Mfg. Co.
Steam
Allis-Chalmers Mfg. Co.

Equipment, High Tension
Electrical Engineers Equip. Co.
Ohio Brass Co.
Schweitzer & Conrad, Inc.

Equipment, Switching
Kearney Corp., James R.

Erectors, Transmission Line
Hoosier Engineering Co.

Fan Motors
Century Elec. Co.
General Electric Co.
Graybar Electric Co.
Peerless Electric Co.
Westinghouse E. & M. Co.

Fans
Wagner Electric Corp.

Fans (Exhaust and Ventilating)
Westinghouse E. & M. Co.

Fault Locators
Matthews Corp., W. N.

Fence, Woven Wire
Copperweld Steel Co.
Cyclone Fence Co.

Financial
Electric Bond & Share Co.

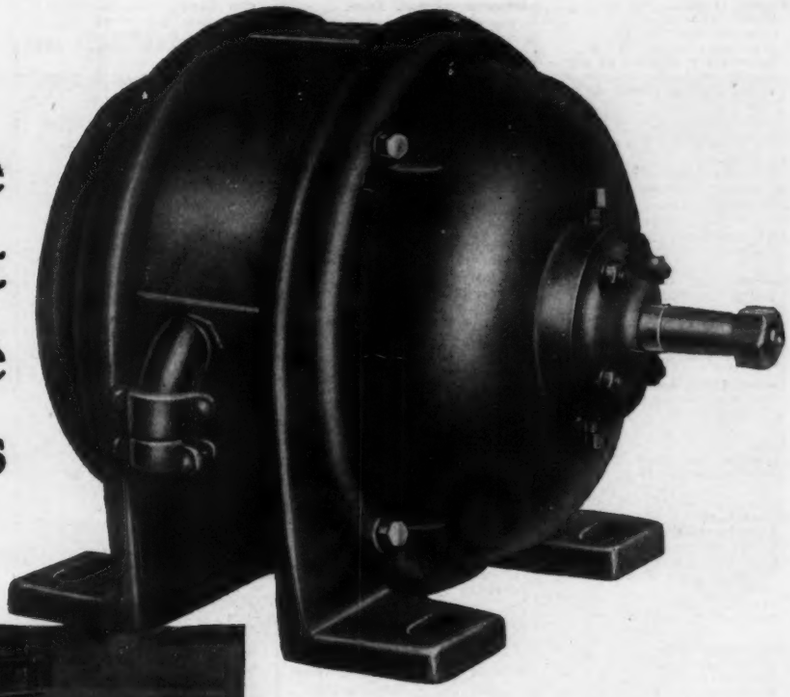
Flooring, Open Steel
Blaw-Knox Co.
Irving Iron Works

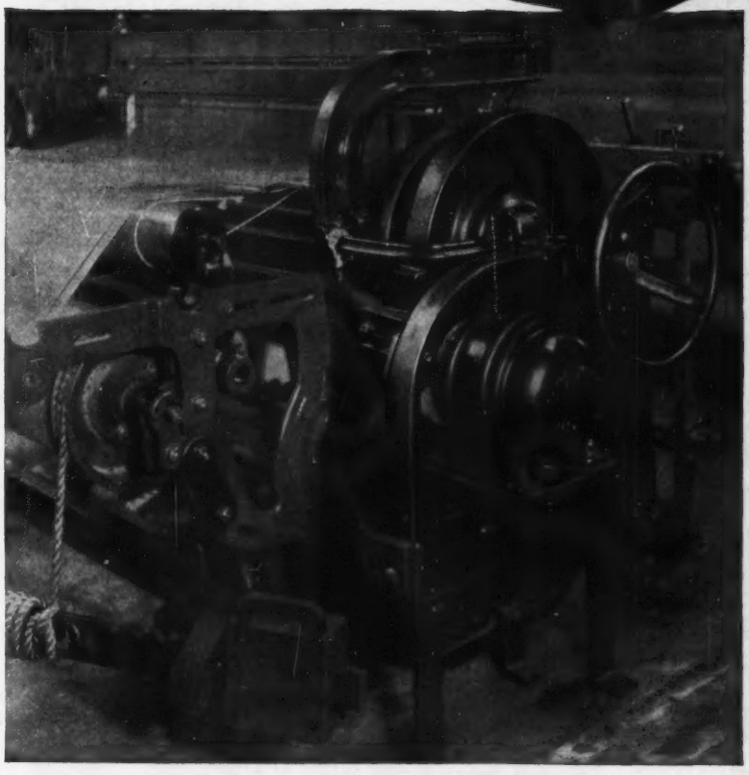
Flooring, Steel
Blaw-Knox Co.
Irving Iron Works

Furnaces, Electric
Pittsburgh Electric Furnace Corp.

Fuses
High Tension
Bowie Switch Co.
Electrical Engineers Equip. Co.

Timkens make Clean, Compact Attention-free Textile Motors





CONTINUOUS, clean, cool operation, maintained with very infrequent attention, is nowhere more valuable than in textile motors. Timken Bearings have helped Diehl textile motors to win favor for these qualities.

Timken Bearings enable Diehl motors to run for months at a time without renewal of lubricant. This is due to the effective bearing seal, as well as to Timken anti-friction properties.

Timkens are the *thrust-radial* anti-friction bearings, providing for all loads from all directions, without compromise. Timken self-contained universal load carrying capacity makes for compactness which saves valuable aisle space, and, for general purposes, makes Timken-equipped motors equally efficient on floor, wall or ceiling!

Only Timken Bearings assure every one of these advantages. For Timkens are exclusive in their combination of Timken tapered construction, Timken *POSITIVELY ALIGNED ROLLS* and Timken-made electric steel.

TIMKEN
Tapered
ROLLER BEARINGS

THE TIMKEN ROLLER BEARING CO.
CANTON, OHIO

Fuses (Cont.)
High Tension
General Electric Co.
Matthews Corp., W. N.
Schweitzer & Conrad Co.
Pacific Electric Mfg. Co.
Westinghouse Elec. & Mfg. Co.
Renewable
Westinghouse E. & M. Co.
Standard
General Electric Co.
Graybar Electric Co.
Westinghouse E. & M. Co.

Galvanizing
Hubbard & Co.

Galvanizing, Hot Dip
Bates Expanded Steel Truss Co.
Cattie & Bros., Jos. P.
Lehigh Structural Steel Co.
Newport News Shipbuilding

Gates, Head and Sluice
Newport News Shipbuilding & Dry Dock Co.

Gears
Celoron Company
Westinghouse Elec. & Mfg. Co.

Generators
Allis-Chalmers Mfg. Co.
Burke Electric Co.
Star Elec. Motor Co.
Westinghouse Elec. & Mfg. Co.
Steam
Babcock & Wilcox Co.

Generating Sets
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse E. & M. Co.
Direct Connected & Geared
Westinghouse Elec. & Mfg. Co.
Motor
Allis-Chalmers Mfg. Co.
Wagner Electric Corp.
Turbine Driven
Westinghouse Elec. & Mfg. Co.

Governors, Water Wheel
Hydraulic
Pelton Water Wheel Co.
Woodward Governor Co.
Mechanical
Woodward Governor Co.

Grating, Steel
Blaw-Knox Co.
Copperweld Steel Co.
Irving Iron Works
Paragon Electric Co.
Truscon Steel Co.

Ground Caps
G. & W. Elec. Spec. Co.

Ground Rods, Galv., Copper
Hubbard & Co.

Ground Rods
Copperweld Steel Co.

Guards, Lamp
Matthews Corp., W. N.

Hardware, Insulator
Ohio Brass Co.
Oliver Iron & Steel Co.
Truscon Steel Co.

Hardware, Pole Line
Ohio Brass Co.
Oliver Iron & Steel Co.
Truscon Steel Co.

Hangers
Cable
Hubbard & Co.

Headlights, Arc and Incandescent
Ohio Brass Co.

Heating Devices
Cutler-Hammer Mfg. Co.
General Electric Co.
Graybar Electric Co.
Westinghouse Elec. & Mfg. Co.

High Voltage Glass
Corning Glass Work "Pyrex"

High Tension Materials
Ohio Brass Co.

Hoists
Electric and Steam
Allis-Chalmers Mfg. Co.
Head Gate
Newport News Shipbuilding & Dry Dock Co.

Indicators, Speed
(See Tachometers)

Indicators, Transformer Load
Westinghouse Elec. & Mfg. Co.

Inspections and Tests
Electrical Testing Laboratories

Instrument Transformers
General Electric Co.
Weston Elec'l Inst. Co.

Instruments
Boiler Room
General Electric Co.
Westinghouse E. & M. Co.
Electrical
Roller-Smith Co.
Graphic
General Electric Co.
Indicating
General Electric Co.
Roller-Smith Co.
Westinghouse E. & M. Co.
Integrating
General Electric Co.
Westinghouse E. & M. Co.
Portable
Roller-Smith Co.
Westinghouse Elec. & Mfg. Co.
Recording
Landis & Gyr, Ltd.
Westinghouse Elec. & Mfg. Co.
Scientific and Testing, Service
General Electric Co.
Roller-Smith Co.
Westinghouse E. & M. Co.
Weston Elec'l Inst. Co.
Transformer
General Electric Co.
Roller-Smith Co.

Insulating Machinery, Wire
American Ins. Machinery Co.

Insulation Material
Asbestos
Deceleco, Inc.
Johns-Manville Corp.
Cement
Mitchell-Rand Mfg. Co.
Compounds, Paints and Varnishes
Celoron Company
Irvington Varnish & Ins. Co.
Mitchell-Rand Mfg. Co.
Westinghouse E. & M. Co.
Comp. Cloth and Paper
General Electric Co.
Irvington Varnish & Ins. Co.
Westinghouse Elec. & Mfg. Co.
Laminated Phenolic Condensation Products
Celoron Company
Lava
Steward Mfg. Co., D. M.
Westinghouse Elec. & Mfg. Co.
Mica, Micarta
Westinghouse Elec. & Mfg. Co.
Molded
Cutler-Hammer Mfg. Co.
Garfield Mfg. Co.
Westinghouse Elec. & Mfg. Co.
Paper
Irvington Varnish & Ins. Co.
Porcelain
Ohio Brass Co.
Square D Co.
Silk
Irvington Varnish & Ins. Co.
Slate
Portland Monson Slate Co.
Tape and Webbing
General Electric Co.
Okonite Co., The
Westinghouse Elec. & Mfg Co.
Transite
Deceleco, Inc.
Treated Fabrics & Paper
Westinghouse Elec. & Mfg. Co.
Untreated Fabrics & Paper
Westinghouse Elec. & Mfg. Co.

Insulation
Electrical
Bakelite Corp.
Celoron Company
Molded
Bakelite Corp.

Insulators
High Voltage Porcelain
Electric Service Supplies Co.
Franklin Porcelain Co.
Lapp Insulator Co., Inc.
Ohio Brass Co.
Porcelain Ins. Corp.
Glass
Lapp Insulator Co., Inc.
Pin Type
Porcelain Ins. Corp.
Railway & Industrial Engr. Co.
Porcelain
Canadian Porcelain Co., Ltd.
Cook Porcelain Ins. Corp.
Ohio Brass Co.
Porcelain Ins. Corp.
Porcelain, Composition
General Electric Co.
Imperial Porcelain Works
Jeffery Dewitt Ins. Co.
Lapp Insulator Co., Inc.
Ohio Brass Co.
Porcelain Ins. Corp.
Thomas & Sons Co., R.
Porcelain and Composition
Square D Co.
Westinghouse Elec. & Mfg Co.

Insulator Pins
Ohio Brass Co.
Oliver Iron & Steel Co.
Thomas & Sons Co., R.

Insulator, Pin Type
Ohio Brass Co.

Irons, Electric
Westinghouse E. & M. Co.

Laboratories
Electrical Testing Laboratories

Lamps
Arc
General Electric Co.
Westinghouse E. & M. Co.
Cable Supporting
Matthews Corp., W. N.
Incandescent
General Electric Co.
Graybar Electric Co.
Westinghouse Elec. & Mfg. Co.
Miniature, Inc.
General Electric Co.

Lighting Equipment, Interior and Exterior
Hubbard & Co.
Westinghouse Elec. & Mfg. Co.

Lighting Standards
Truscon Steel Co.

Lightning Arresters
Electric Power Equip. Corp.
Electric Service Supplies Co.
Electrical Engineers' Equip. Co.
General Electric Co.
Hubbard & Co.
Pacific Electric Mfg. Co.
Ry. & Industrial Eng. Co.
Schweitzer & Conrad, Inc.
Westinghouse E. & M. Co.

Line Material
Electric Service Supplies Co.
General Electric Co.
Hubbard & Co.
Ohio Brass Co.
Oliver Iron & Steel Co.
Truscon Steel Co.
Westinghouse E. & M. Co.

Lineman's Safety Platform
Hubbard & Co.

Linemen's Supplies and Tools
Prest-O-Lite Co., Inc.

Locomotives, Electric
Westinghouse Elec. & Mfg. Co.

Lugs
Sherman Mfg. Co., H. B.

Machinery
Mining
Allis-Chalmers Mfg. Co.

Machines, Washing
Graybar Electric Co.

Machines, Welding
Westinghouse Elec. & Mfg. Co.

Magnets
Cutler-Hammer Mfg. Co.

Magnets, Lifting
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.

Meter Testers
General Electric Co.
Westinghouse E. & M. Co.

Meters
Demand
Landis & Gyr, Ltd.
Westinghouse Elec. & Mfg. Co.
Kilovolt Amperes
Landis & Gyr, Ltd.
Westinghouse Elec. & Mfg. Co.
Recording
Tanner Eng. Co.
Remote Indicating
Tanner Eng. Co.
Watthour
Duncan Electric Mfg. Co.
Landis & Gyr, Ltd.
Westinghouse Elec. & Mfg. Co.

Meters, Flo
(See Instruments Electric and Boiler Room)

Molded Insulation (See Insulation, Molded)

Molded Parts
Garfield Mfg. Co.

Molding Materials
Bakelite Corp.
Celoron Company

Motors
Allis-Chalmers Mfg. Co.
Baldor Electric Co.
Burke Elec. Co.
Century Electric Co.
General Electric Co.
Graybar Electric Co.
Imperial Electric Co.
Lincoln Electric Co.
Marble-Card Elec. Co.
Peerless Electric Co.
Star Elec. Motor Co.
Wagner Electric Corp.
Westinghouse Elec. & Mfg Co.
Zobell Elec. Motors Co.
Mine
Westinghouse Elec. & Mfg. Co.
Railway
Westinghouse Elec. & Mfg. Co.
Small
Domestic Electric Co.
Westinghouse E. & M. Co.

Motor Generator Sets
Burke Elec. Co.
Star Elec. Motor Co.

Oil Burners
Babcock & Wilcox Co.

Oil Engines (See Engines)

Overhead Line Materials
Ohio Brass Co.
Oliver Iron & Steel Co.

Paint
Anti-Corrosive
Dampney Co. of America
Heat Resisting
Dampney Co. of America
Steel Preservative
Dampney Co. of America

Painting Equip. Mech. or Elec'l.
Matthews Corp., W. N.

Paints, Aluminum
Aluminum Co. of America

Panel Boards
Celoron Company
General Electric Co.
Trumbull Elec. Mfg. Co.

Panels, Switchboard
Allis-Chalmers Mfg. Co.
General Electric Co.

Penstocks
Newport News Shipbuilding & Drydock Co.

Pins, Insulator
Hubbard & Co.
Ohio Brass Co.
Oliver Iron & Steel Co.

Pipe
Riveted Steel
Newport News Shipbuilding & Dry Dock Co.
Riter-Conley Mfg. Co.

Pipe Frame Fittings, Elec'l
Electrical Engineers Equip. Co.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg Co.

Plugs
Attachment and Cap
General Electric Co.
Westinghouse E. & M. Co.
Attachment
Cutler-Hammer Mfg. Co.
General Electric Co.

Pole Line Hardware
Electric Service Sup. Co.
Graybar Electric Co.
Hubbard & Co.
Ohio Brass Co.
Oliver Iron & Steel Co.
Truscon Steel Co.
Westinghouse Elec. & Mfg. Co.

Poles
Cedar
Bell Lumber Co.
Chestnut
Frankfort Lumber Co.
Creosoted Southern Pine
Graybar Elec. Co.
Iron
Archbold-Brady Co.
Steel
Aermotor Co.
Archbold-Brady Co.
Bates Expanded Steel Truss Co.
Lehigh Structural Steel Co.
Riter-Conley Mfg. Co.
Truscon Steel Co.
Wood
American Creosoting Co.

Poles, Reinforcing of
Hubbard & Co.
Truscon Steel Co.

Potentiometers
General Electric Co.
Westinghouse Elec. & Mfg. Co.

Potheads
Electrical Engineers Equip. Co.
G. & W. Elec. Spec. Co.
Ohio Brass Co.
Railway & Industrial Engr. Co.

Preheaters, Air
Blaw-Knox Co.

Projectors, Floodlighting
Elec. Service Supplies Co.
Westinghouse Elec. & Mfg Co.

Pullers, Slack
Matthews Corp., W. N.

Pumps
Centrifugal
Allis-Chalmers Mfg. Co.
Pelton Water Wheel Co.
Wheeler Mfg. Co., C. H.
Reciprocating
Allis-Chalmers Mfg. Co.
Vacuum
Wheeler Mfg. Co., C. H.

Racks, Cable
G. & W. Elec. Spec. Co.

Racks, Intake
Newport News Shipbuilding & Drydock Co.

Racks, Secondary
Hubbard Co.
Oliver Iron & Steel Co.

Radio Apparatus
Cutler-Hammer Mfg. Co.
General Electric Co.
Westinghouse E. & M. Co.

Rail Bonds
American Steel & Wire Co.
Copperweld Steel Co.
Ohio Brass Co.

Rake, Rack
Newport News Shipbldg. & Drydock Co.

Ranges, Electric
Westinghouse Elec. & Mfg. Co.

Rectifiers
General Electric Co.
Wagner Electric Corp.
Westinghouse E. & M. Co.

Reels, Take-Up and Pay-Out
Matthews Corp., W. N.

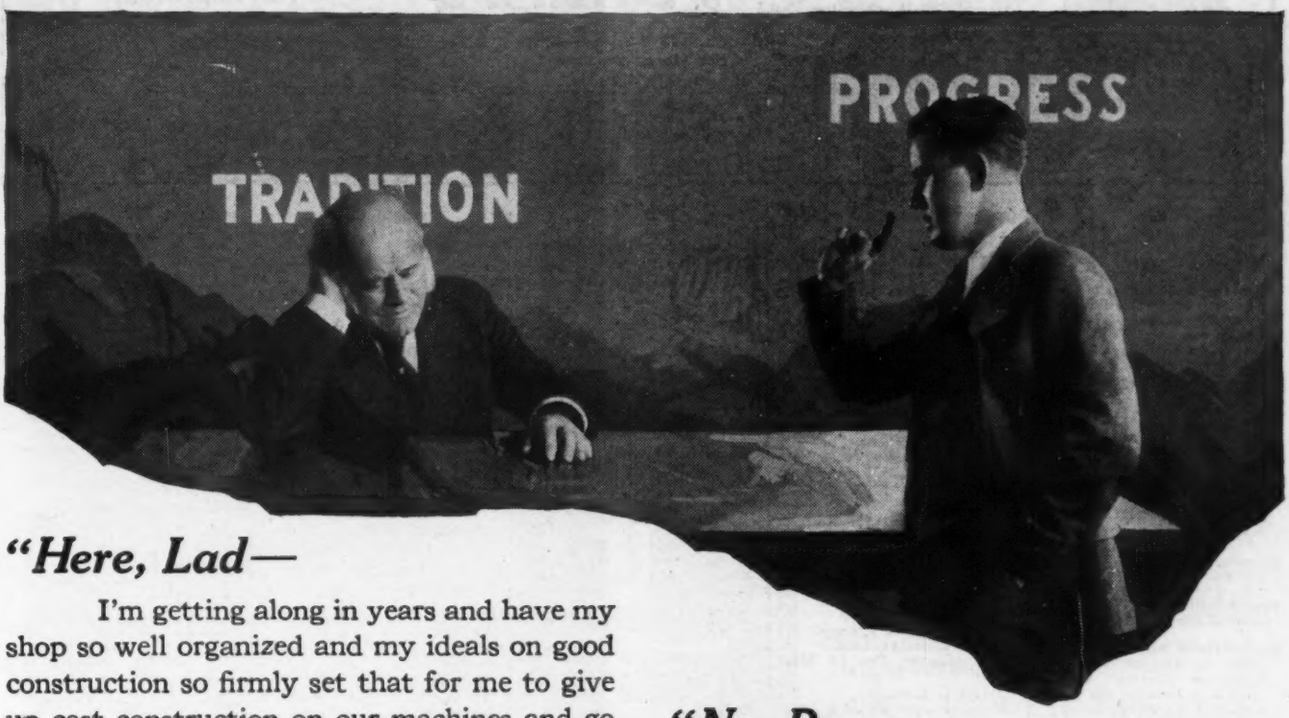
Refrigerators
General Electric Co.

Regulators, Feedervoltage
Westinghouse Elec. & Mfg Co.

Relays
Electric Controller & Mfg. Co.
Roller-Smith Co.
Westinghouse Elec. & Mfg. Co.

Repairing
(See Searchlight Section)

Economy of manufacture depends on modern methods



"Here, Lad—

I'm getting along in years and have my shop so well organized and my ideals on good construction so firmly set that for me to give up cast construction on our machines and go to arc welding—well, I'm just too old to learn."

Only "Stable-Arc" Welders have all these features

Variable Voltage.
Laminated Magnetic Circuit.
Separately-excited Generator Field.
Double Control of Welding Heat.
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W-49

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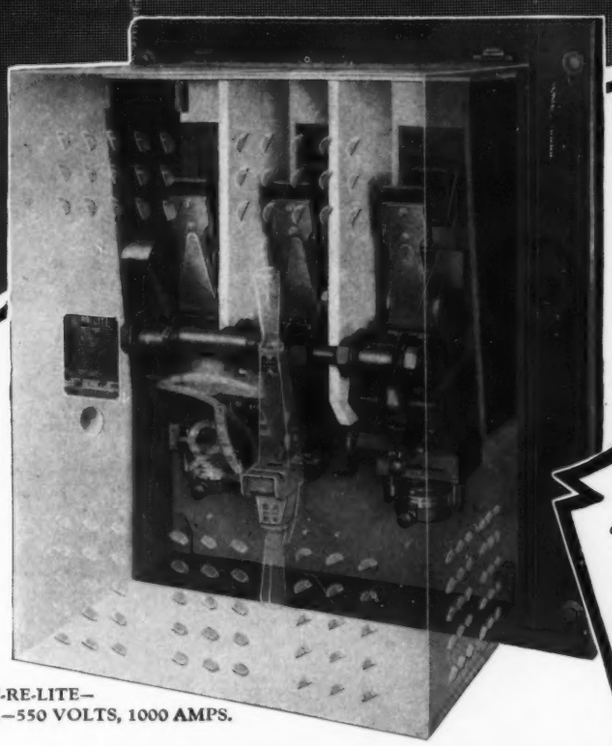
FROM 1000 AMPERES TO ½ AMPERE



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